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CONSERVATION PLAN

BACKGROUND REPORT

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CONSERVATION PLAN BACKGROUND REPORT

City Plan Case No. 24578

City planning Los Angeles
Conservation " "

Prepared by:

Los Angeles City
Planning Department,

Citywide Planning and
Development Division

Comprehensive Plans Unit

June, 1973

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CONSERVATION PLAN
AN ELEMENT OF THE GENERAL PLAN

Preface

Environment refers to the totality of man's surroundings, both social and physical, both natural and man-made which human, plant and animal communities depend upon for survival and well-being and which influence the quality of life for all ecological communities.

"Conservation ... can be defined as the wise use of our natural environment: it is, in the final analysis, the highest form of national thrift -- the prevention of waste and despoilment while preserving, improving, and renewing the quality and usefulness of all our resources."

President John F. Kennedy
Conservation Message to
Congress (1962)

Under the explosive pressures of expansion in Los Angeles, as all around the nation, there has been an unprecedented assault on the natural environment. In a great surge toward "progress" technological advances have enabled us increasingly to foul our air, water, and land. Paradoxically, as our economic standard of living steadily rose, the environmental standard of living steadily deteriorated.

Los Angeles was settled because of the unique qualities of its physical location. But development has eclipsed some of these qualities and a serious threat now exists to the future enjoyment of the natural amenities.

Conservation has not normally been considered an urban concern. Plans for the accommodation of large numbers of city dwellers have habitually given scant attention to the natural elements of land, water, air and minerals. Instead, priority has been given to immediate problems such as housing, location of industries, provision of public facilities, and private transportation.

Yet, environmental forces can aggravate social and economic problems. For instance, urban sprawl increases the cost of transportation and municipal services from the core area as it moves outward and leaves the poor in central city ghettos. Further, air pollution affects the growing of certain crops, causing millions of dollars in damage and limiting quantities available for market, thereby increasing their price; noise and confusion have mounted with the rising tempo of technology also, the indiscriminate use of pesticides is being felt by the fishing industry, even though far removed from agricultural areas where pesticides are used.

With greater knowledge of these cause-and-effect relations and a growing concern for high quality living in the City, we must learn to develop human habitats without increasingly polluting the air, water, and land. Population and growth pressures must not be allowed to overshadow such considerations as flood prevention, water shortage, water pollution, recharging of ground water basins, loss of watershed lands, fire hazards, geologic hazards and loss of recreation and scenic values. One purpose of the General Plan is to attain balance and harmony between the complex forces of the natural world and man-made development. This means greater consideration of soil and subsoil conditions, land forms and geological faults, flood and drainage problems, waste disposal, plant and animal life, pollutants, and the whole range of ecological factors.

It is unrealistic to assume that the environment cannot assimilate some level of change; some degree of pollution is inevitable with the rising standard of living and an increasing population. However, the delivery of systems to abate pollution can also create jobs: design, manufacture, installation and maintenance. It is important to identify the factors that do the least violence to the environment while attempting to accomplish the ends that society deems important.

All proposed human actions do not necessarily have to result in environmental destruction. All parties, public and private, must take into account what can be done to ameliorate detrimental effects after a project has been completed. That is, even though there may be adverse effects, some of these can be abated if thought is given to improvement actions that could be instituted at the project's completion, often at a nominal cost by comparison to their benefits.

For purposes of simplicity and organization, the Background Paper that follows has been divided into separate chapters dealing with the environmental concerns set forth in Section 65302 (d) of the California Government Code. Additionally, two concerns not specifically called for in the State law are included: air quality and preservation of archaeological-paleontological findings.

WATER RESOURCES

INTRODUCTION

Every beneficial use of water exposes it to possible contamination and creates a threat of quality degradation. There is an unending cycle of water in the environment from contamination to purification and back to contamination. Rain and snow falling through the atmosphere cleans the air by dissolving contaminants and physically washing out particulate matter. The runoff of waters over the land adds further soluble and insoluble natural contaminants to the water cycle. Nature both creates pollution conditions and also provides the means whereby water subsequently purifies itself. When man disturbs the natural water cycle by creating more waste than can be handled through the natural cleansing process, water quality problems develop.

As a limited natural resource, water should be protected and conserved. Los Angeles is fortunate in having avoided most of the serious water pollution problems that face other cities. This is not to say that no problem exists. One needs only to travel to the Los Angeles Harbor to know that there are still some local water pollution problems. Long before conservation and ecology became prime issues, concerned City agencies had been working to forestall the types of problems faced by many other urban centers. Large sums of money have been invested by the Departments of Water and Power and Public Works in physical plant and equipment. These, as water distribution systems, flood control and sewerage facilities have protected the health and safety of the citizens.

With continued population and industrial growth, it will be increasingly more difficult to maintain the high water quality levels required for the various beneficial uses of this vital resource. Maintenance of water quality and the elimination of water pollution will continue to pose a challenge to the City in the years to come.

GENERAL CONSIDERATIONS

Various aspects of water resources which must be considered in Los Angeles include water quality, water supplies, wastewater disposal, water reclamation, industrial wastes, the Los Angeles Harbor, heated water discharge, water recreation and storm water runoff. These are not all discrete problems; each one may have an influence upon another. There are a number of indirect factors which may ameliorate or intensify these problems that include geographical factors, jurisdictional questions and meteorological variables, especially storms.

GEOGRAPHICAL FACTORS

Los Angeles is located in a semi-arid area on the sea-coast. Because of its limited local water resources, it is largely dependent upon imported water (88%) from the Owens Valley and the Colorado River. The proximity of the ocean has led to the treatment and off-shore discharge of wastewater. The relative isolation of water supply sources has minimized the effect of man-made pollution on domestic water quality.

Currently, the need to expand the City's existing wastewater treatment program, coupled with significant improvements in technology, enable the City to plan and develop inland wastewater treatment plants. Effluent processed by these facilities can be reclaimed for further beneficial uses. This reclamation of water will aid in its conservation to meet the growing need for this limited natural resource.

JURISDICTIONAL CONSIDERATIONS

Water Quality

Water quality standards are established by the California State Public Health Service and the State Water Quality Control Board. Except for drinking water standards, the California Regional Water Quality Control Board, Los Angeles Region, has the responsibility for establishing standards for the protection of the water for all beneficial uses. Beneficial uses of water of the State that may be protected against quality degradation include, but are not necessarily limited to the following:

Municipal and Domestic Supply - includes usual community uses and individual use for domestic purposes.

Agricultural Supply - includes crop, orchard and pasture irrigation, stock watering and all uses in support of farming and ranching operations.

Industrial Supply - includes use for cooling water and processing.

Groundwater Recharge - recharge for later extraction for municipal, industrial, recreational and agricultural uses.

Water-Contact Recreation - all recreational uses involving actual body contact with water such as swimming, wading, water sports - water skiing, skindiving, surfing, sport fishing-lake, stream, ocean.

Non-Water Contact Recreation - recreational uses which involve the presence of water but do not require contact with water, such as picnicking, sunbathing, hiking, beachcombing, tidepool and marine life study, camping, aesthetic enjoyment, pleasure boating and waterfowl hunting.

Clamming and shellfish harvesting

Commercial Fishing

Navigation - includes commercial and naval shipping.

Scientific study, research and training - includes marine life refuges.

Marine Habitat - provides habitat for fish propagation and sustenance, shrimp, crab and other shellfish, waterfowl, and other water-associated birds, and mammal rookery.

Freshwater Habitat - provides freshwater habitat for fish, waterfowl and wildlife.

Water Supply

The Department of Water and Power (DWP) has the responsibility of supplying, conserving, treating and distributing water for fire fighting, agriculture, domestic and industrial uses. The DWP also has the responsibility of additional treatment of wastewater to meet beneficial uses of the City.

DWP has approximately 100 reservoirs within the system; due to the scale of mapping, only the major reservoirs and their surrounding lands are indicated in this Plan. Water recharge areas (spreading grounds) are located in Pacoima, Sun Valley, Sylmar and the Tujunga Wash.

Flood Control

Three separate agencies, the United States Army Corps of Engineers, Los Angeles County Flood Control District and the City's Department of Public Works are responsible for drainage and flood control in Los Angeles.

In general, the Corps of Engineers is responsible for the improvement of the larger streams which traverse the metropolitan area. Its projects are built to protect against storms of such intensity that they occur on an average of once every one hundred years.

The County Flood Control District's channels are built to accommodate the waters of a "capital" or fifty-year storm, while Los Angeles City and the Flood Control District normally design their underground drainage facilities to provide relief from the effects of a storm of ten-year severity.

Wastewater

The City's wastewater system is under the jurisdiction of the Bureau of Sanitation, Department of Public Works. The wastewater system includes the facilities necessary for the collection, treatment and disposal of domestic, commercial, and industrial wastewaters. It is separate and distinct from the City's storm drain system, which is described in the Drainage System Plan, also an element of the General Plan.

Water quality standards for the City's treated wastewater are established by the California Regional Water Quality Control Board, Los Angeles Region. These standards are determined after public hearings for the purpose of defining and protecting the beneficial uses of receiving waters. The standards may specify various levels of water quality in the effluent receiving waters or both.

The Bureau of Sanitation operates two plants for the treatment of wastewater. Approximately 95 percent of the City's wastewater is processed at the Hyperion Treatment Plant (capacity 420 million gallons daily or mgd) located on a 144 acre site overlooking Dockweiler Beach. About three percent of the City's wastewater, mostly from Wilmington and San Pedro, is treated at a plant located on Terminal Island having a capacity of 14 mgd in 1971. Additionally, the Valley Settling Basin is operated as an experimental facility.

Approximately 60 mgd of the wastewaters treated in the Los Angeles City wastewater system are received from adjoining cities and Los Angeles County Sanitation Districts under contractual agreement. The largest quantities come from Glendale, Burbank, Santa Monica, Beverly Hills, Culver City and West Hollywood. About three percent of the City's wastewater volume is processed by the Los Angeles County Sanitation District.

Water Recharge

Groundwater recharge operations are the responsibility of the Los Angeles County Flood Control District and the Department of Water and Power. The Department of Water and Power spreads both local and imported water within the headlands and Tujunga spreading grounds. In the future, the Department intends to continue spreading these waters plus water reclaimed from wastewater.

The Los Angeles County Flood Control District maintains four spreading basins within the Upper Los Angeles River Basin. These include the following: Branford, Hansen, Lopez and Pacoima. Natural waters are spread within the basins.

The Upper Los Angeles River Area (ULARA), which includes all the watershed of the Los Angeles River easterly to Eagle Rock, is administered by the Department of Water Resources, State of California, as a Watermaster Service Area under the provisions of the California Water Code.

Watermaster service areas serve other sections of the City. These service areas include the Central Basin and the West Coast Basin. The ULARA basin has been operating for several years on a management plan which limits and monitors groundwater extractions. The ULARA was established by judgment of the Superior Court Case No. 650,079, entitled the "City of Los Angeles, a Municipal Corporation, Plaintiff vs. City of San Fernando, et al. Defendants," judgment signed March 14, 1968. The City has filed an appeal with the Court of Appeals. This appeal will not be heard until the middle of 1973.

Other Jurisdictional Problems

Although the City maintains a relatively strict monitoring system of plant discharges, it has no control over industrial discharges made outside its boundaries into channels that are eventually tributary to the Los Angeles Harbor, such as the upstream portion of the Cerritos Channel.

The inadequacies of local jurisdiction are overcome by the California Regional Water Quality Control Board, Los Angeles Region. This Board, in executing its jurisdictional powers over the waters of the State, has established discharge requirements that will result in improved water quality in the Los Angeles Harbor.

Another major problem affecting the Harbor is that of discharges from flushing tanks on ships berthing at the Port of Los Angeles. Most of these ships are foreign-flag vessels whose nations of registry do not require holding tanks or treatment plants to be built aboard them. Anti-pollution requirements must be established at the national level to be enforceable.

CONSERVATION ELEMENT CONCERNS

Water and Its Hydraulic Force

Foothill and mountain lands are the primary watersheds of the Los Angeles area. The City of Los Angeles has two adopted plans relating to watersheds: the Water System Plan and a Drainage Plan. There is an interdependency between these two service functions. Consideration of watershed includes consideration of water resources, rivers, flood control, water reclamation and ground water recharge. The only river of consequence in the City is the Los Angeles River. Its character has been altered from that of a river to a channelized flood control project; it now flows underground. Therefore, when reference is made to the Los Angeles River, the context is primarily flood control. For this reason, a major section on rivers is not included in this Plan; however, objectives, policies and programs concerning flood control facilities in the Drainage Plan are considered to apply.

Urbanization generally increases the volume of water runoff. The Division of Soil Conservation of the State Resources Agency has stated that ... "The volume of runoff is governed primarily by the infiltration characteristics of the land which is related to slope, soil type, and cover. The change in the cover of land by urbanization with impervious surfaces of roofs, streets, and other improvements directly and most significantly alters the runoff volume ..." ¹This same study provides the following chart which relates the number of flood flows with urbanization to the number before urbanization:

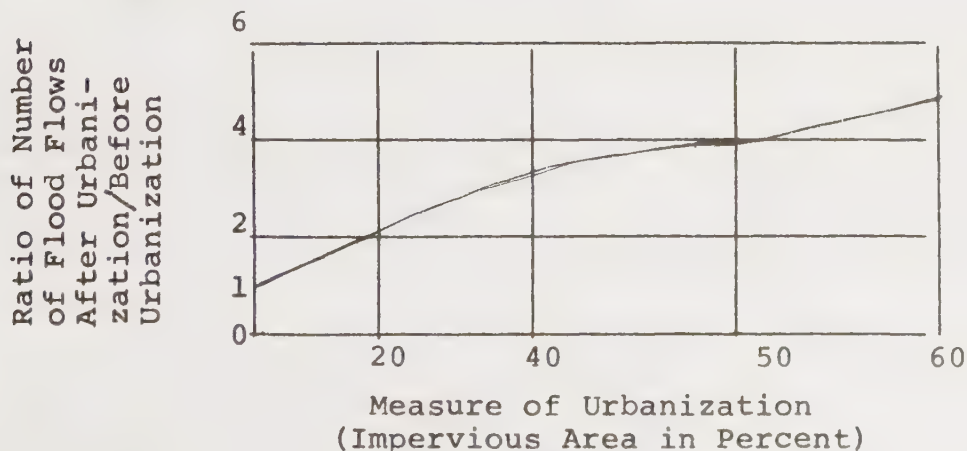


Figure 1

¹ Division of Soil Conservation, Department of Conservation, Resources Agency, State of California, Environmental Impact of Urbanization on the Foothill and Mountain Land of California, November 1971, p. 1.

Recognizing this relationship of flood flows to degree of imperviousness, the City is proposing the maximum amount of open space in mountain and foothill areas. These provisions are included in the Proposed Open Space Plan, Open Space Zone and revisions of the City's Subdivisions Regulations. Chapter III of this report, "Soils", discusses the relationship of road density to sediment production runoff volume and watershed problems and should be referred to for its relationship to the hydraulic force of water.

Hydroelectric Power

One of the primary uses of the hydraulic force of water is the production of electric power within the City. There are no major hydroelectric dams, such as Hoover Dam, within the City; however, the Department of Water and Power operates three hydroelectric power plants within the City of Los Angeles. These are as follows:

Franklin Power Plant	Rating	2,000 kilowatts
Foothill Power Plant		11,000 "
San Fernando Power Plant		5,600 "

In addition to these plants, DWP operates a series of ten hydroelectric plants, with a total energy rating of 226,725 KW, along the Los Angeles Owens River Aqueduct from Crowley Lake in Mono County to the southerly terminus of the aqueduct at the Cascades in Sylmar.

The City's Flood Control System

The U.S. Army Corps of Engineers is responsible for the improvement of larger streams running through the City. As previously stated, the Corps projects are built to protect against more severe storms than are those of the Flood Control District and the City.

Two major flood control facilities have been constructed by the Army Corps of Engineers: Hansen and Sepulveda Dams. These flood control basins, occupying several thousand acres in the San Fernando Valley, are noticeable features of the Plan. Although their primary function is flood control, compatible secondary uses such as agriculture, recreation and research are permitted.

The City and the County Flood Control District normally design their underground drainage facilities to provide relief from the effects of a storm of ten year severity. Along watercourses and sumps (areas of interior drainage where water ponds after a storm) relief from fifty year storms is provided.

City streets perform the function of drains where they are not underlain by such facilities. When new subdivisions are developed, storm drains are required when the expected runoff from a ten-year storm will render streets unusable.

The primary concern in routing and handling storm water runoff is to prevent the loss of life and minimize property damage. The efficiency with which this is achieved is shown by the relatively small amount of damage caused by the severe storms in 1969.

The recurrence interval for total rainfall during this nine day storm was more than 150 years.² Because of the dry watershed conditions, runoff volume was low during the first phase of the storm and most of this rainfall was absorbed by the soil. The long duration of the storm and high intensity during the latter days supersaturated the soil mantle resulting in severe erosion and heavy runoff. This runoff filled most of the County Flood Control District's reservoirs to capacity and utilized a great deal of the storage capacity of Sepulveda and Hansen Dam Flood Control Basins.

One consequence of this storm was the filling of Hansen Dam Lake with tons of silt and gravel, resulting in a loss of many previous recreational uses at the lake. But, by and large, the complex flood control system in the City was able to withstand the onslaught of the seemingly constant rains, and the system worked well to hold down the level of damage.

A secondary concern in the handling of storm water runoff is the conservation of water. This is achieved by the use of reservoirs and retention basins where waters are stored during peak flow periods for release at a later time. One consideration is the recovery of the water itself. Another consideration is the quality of the runoff and whether it is suitable for reuse, or whether it should best be discharged to the ocean. Some of the parameters that must be considered are the material in suspension, i.e., dirt, silt, and particulate matter from street runoff; and, the presence of contaminants such as pesticides which may result from agricultural or domestic uses.

² Simpson, Larry D. Summary Report-Storms of 1969, p. 8.

Flood control is largely the responsibility of the Los Angeles County Flood Control District (LACFCD); however, over twelve hundred miles of storm drains underlie the streets of the City, of which over nine hundred miles are directly under City jurisdiction. These facilities funnel storm water runoff into larger open channels, reducing the volume of storm waters that are channeled through City streets. Yet, many intersections and streets throughout Los Angeles are still inundated during heavy rain storms.

Needs for additional flood control protection are filled as funding allows. A Flood Control District bond proposal of approximately \$250.0 million was approved by the electorate in 1970.³ This provided an allocation of \$70.0 million directly to cities, based on population and total assessed valuation. The City of Los Angeles was scheduled to receive about \$28.0 million of the \$70.0 million for drainage facilities.

The balance of the bond issue was planned to finance regional projects. In this bond proposal, City boundaries were not taken into account; drainage deficiencies were studied on a regional basis for ten study areas. On this basis, the City was allocated 23 large-scale projects. Of these, ten are to be located in the San Fernando Valley. As individual projects are proposed, Environmental Impact Reports are required.

With respect to mountain development and flood control, the LACFCD first determines how much development is expected to take place in an area, and then prepares plans for this maximum development. The feasibility of dams, channels downstream of the dams, and debris basins are all studied. Runoff is calculated based on these studies.

As much as is practicable, flood control channels are designed to be compatible with each community. In the past, not too much attention was paid to landscaping; it increases maintenance costs and may require purchase of additional land adjacent to the channel. But, elements of flood control channel beautification are now being incorporated by the LACFCD as funds permit. Additionally, the LACFCD is cooperating in feasibility studies to make many of their rights-of-way available for limited recreation including bicycle and equestrian trails.

³ Personal Communication, Louis A. Vita, Assoc. Civil Engineer
Los Angeles County Flood Control District, April 30, 1970

The District attempts to incorporate community ideas into the design of a project. Community meetings are held prior to beginning new projects. Additionally, the District is designing over longer periods of time in order to enable the community to become more familiar with the project.

Some communities prefer natural-bottom channels. However, natural bottom channels are more expensive to maintain. Moreover, these channels cannot be put into all types of terrain because the water velocity must be controlled. This cannot easily be done on a steep slope, therefore, natural bottom channels are generally restricted to flat land.

Treating Storm Water

In the future, it may become more economically feasible to catch and treat storm flows. Water reclamation plants are currently scheduled to be built near flood control basins and channels now in existence. Methods may be found whereby storm water can be impounded during heavy rainfalls and then gradually emptied through channels leading to treatment facilities. If a facility were built to treat only storm water, it would stand idle most of the year. Therefore, plans to divert storm waters to treatment plants have to be coordinated with good flood control practices and water conservation purposes in mind.

Full treatment of storm water may not be warranted, depending on the beneficial uses of the water. Secondary treatment is desirable for most uses because the primary treatment process results only in the removal of particulate matter and visible pollutants. Systematic studies should be undertaken on the quality of urban storm water in order to assess the most feasible alternative for treatment for its beneficial uses.

DWP Policies for Flood Control and Runoff

Department of Water and Power's two primary concerns regarding runoff and flood control are protection of the water storage reservoir and its water quality, and protection of downstream residential areas. In terms of water quality, the ultimate criterion would be to completely divert storm runoff away from the reservoir.

In some cases, this is not economically feasible due to the high cost of diversion structures or the unavailability of public storm drain facilities below the watershed area. Therefore, the DWP maintains a policy of optimal balance between maximum runoff diversion and minimum cost.

Protection of downstream residences is of great concern to the DWP but, in most cases, control of the diverted storm runoff is left to the Department of Public Works and the Los Angeles County Flood Control District. Methods employed by DWP to protect downstream residences from this runoff vary with the physical and economic constraints of the particular reservoir, and can be classified into three general categories: (1) total diversion of the storm runoff from the reservoir to public storm drain facilities, (2) to protect residences by allowing the entire upstream runoff to enter the reservoir, and (3) a combination of numbers 1 and 2 above.

The criteria for DWP policy on the use of land surrounding the reservoirs by public or private interests is based on watershed protection, or more specifically, on the need to prevent contaminants from entering the reservoirs. Under this guideline, most requests for use of land at reservoirs without a complete storm flow bypass facility are discouraged. At Chatsworth and Van Norman Reservoirs, where the bypass facilities have been fully developed, DWP has outlined some possible future uses of excess lands surrounding the reservoirs. These possibilities include the development of golf courses, parks, camping and picnicking areas.

For the remainder of the reservoirs, the use of the surrounding land is limited to controlled activities which would not endanger the reservoir water quality. At some future date, when complete bypass facilities are developed, the land surrounding these reservoirs can also be used in a manner similar to that contemplated for Chatsowrth and Van Norman.

WATER RESOURCES AND WATER QUALITY

Water Supplies

During the Fiscal Year 1971-72, Los Angeles received approximately 78 percent of its water through its Los Angeles-Owens River Aqueduct Systems. These waters are primarily derived from melting snows from the eastern slope of the Sierra Nevada Mountains, supplemented by water produced from City-owned wells in the Owens Valley.

Approximately 12 percent of the City's water supply comes from the underground basin of the Los Angeles River and the coastal plain. All groundwater is carefully protected by positive programs to prevent pollution, including groundwater monitoring, regulation of industrial wastes, limitations on solid waste disposal sites and bacteriological studies. The balance of the City's water supply, or approximately 10 percent in 1971-72 was supplied by the Metropolitan Water District. This water supply comes from the Colorado River and the State Water Project (See Chart 1).

Prior to entering the City's water distribution system, all waters are chlorinated to assure their bacteriological safety. The chlorine dosage used is about one part per million, or approximately eight pounds of chlorine per million gallons of water.

Future water requirements will continue to grow because of industrial requirements and increasing City population. These expanding needs will be even more acute because of the possible curtailment of water from the Colorado River. Additional water sources that will be utilized by the Department of Water and Power include the purchase of water from the State Water Project and the development of water reclamation programs to reclaim wastewater for industrial use or for the recharge of groundwater basins.

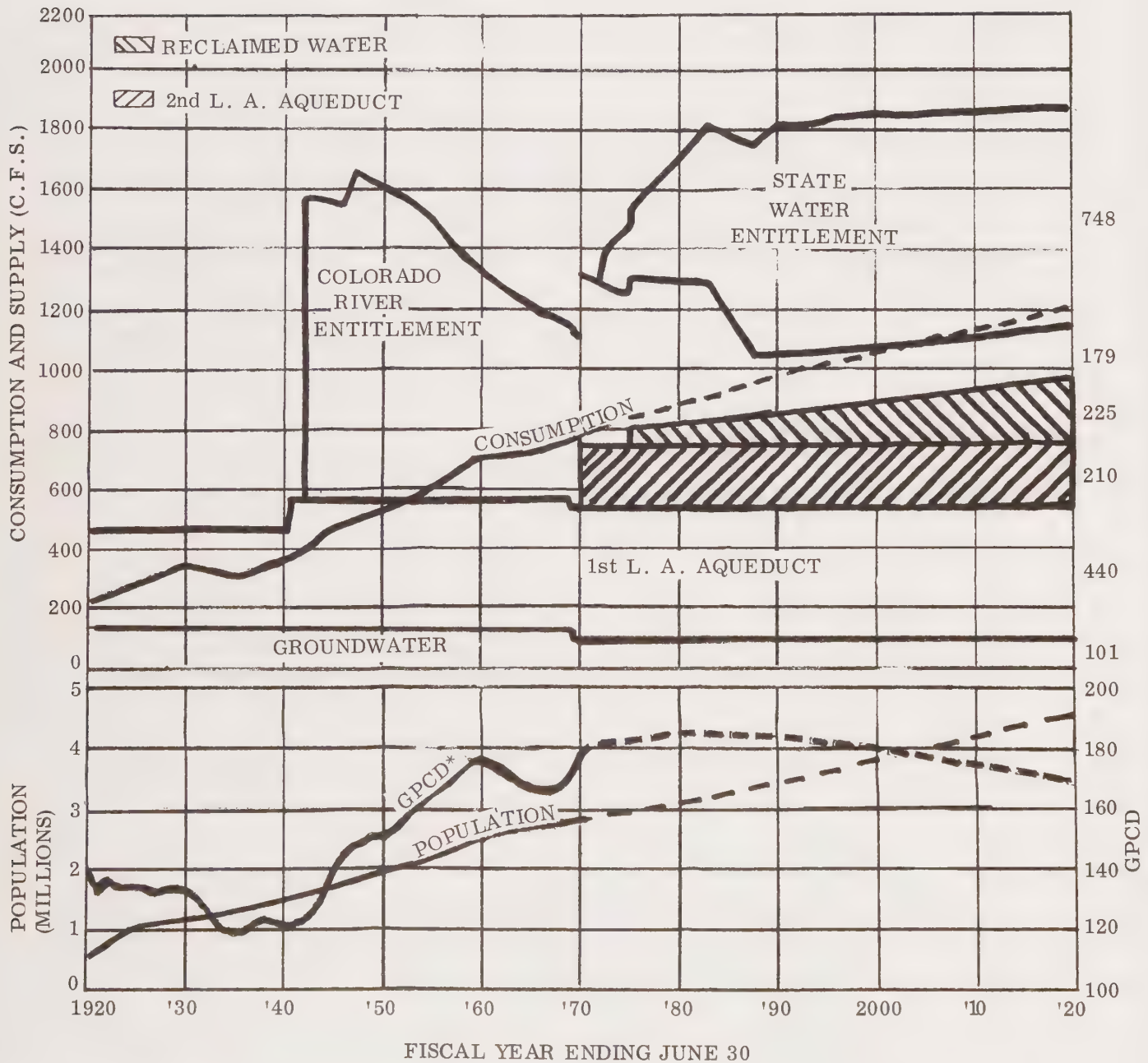
Water Quality

Annually, DWP conducts approximately 50,000 laboratory and field analyses to monitor the quality of the water supply. About 15,000 of these tests are for bacteriological control and the balance in physical, chemical or microscopical testing (See Table 1). The effectiveness of this treatment and monitoring program is affirmed by records which show that no water-borne disease has been traceable to the Los Angeles municipal water supply.

Figure 2

LOS ANGELES WATER SYSTEM

POPULATION-CONSUMPTION-SOURCE OF SUPPLY



Source: Los Angeles City Department of Water and Power

* Gallons per capita daily

The U.S. Public Health Service has promulgated the Public Health Service Drinking Water Standards - 1962. These are the standards which drinking water, water supply systems used by interstate carriers and others subject to Federal quarantine regulations must conform. In general, these standards have been adopted by State Public Health agencies for application to public water supplies. Revision of these standards is anticipated in the proposed 1972 Environmental Protection Agency (EPA) Drinking Water Standards.

In the Mono Basin and Owens Valley areas, recreational use of the watershed is permitted. This is done under a cooperative program between the Department of Water and Power, the Forest Service, and the local and state public health agencies. Steps are taken to assure that recreational use will not cause harm to the domestic water supply.

The Owens Valley is a sparsely settled area, with only a few widely separated towns. In cooperation with other agencies, including the California Regional Water Quality Control Board, discharges of domestic wastewater are regulated, and are not considered to be a significant source of pollution.

TABLE 1

COMPLETE ANALYSES OF LOS ANGELES WATER SOURCES
1971-1972 Averages
Chemical Results in mg/l (PPM)

Department of Water and Power - City of Los Angeles

	LOS ANGELES OWENS RIVER AQUEDUCT	LOS ANGELES RIVER SUPPLY CONDUIT	METROPOLITAN WATER DIS- TRICT (Upper Feeder)	(Palos Verdes Reservoir)
Spec. Elec. Cond. (KX10 ⁶)	320	621	1277	1243
+Dissolved Residue (Calc.)	199	384	802	790
Total Hardness as CaCO ₃	82	200	151	230
pH	8.36	7.97	8.17	8.10
Saturation Index	+0.16	+0.17	+0.02	+0.10
Stability Index	8.04	7.63	8.13	7.90
Calcium	24	57	36	56
Magnesium	5.1	14	15	22
Sodium	33	49	216	177
Potassium	3.6	3.8	4.9	4.8
Barium	<0.1	<0.1	0.1	0.1
*Strontium	0.18	0.45	0.50	0.6
Carb. Alkalinity as CaCO ₃	0	0	0	0
Bicarb. " " "	113	141	126	123
Sulfate	28	110	338	341
Chloride	14	37	105	105
Nitrate (as NO ₃)	0.8	6.1	2.1	1.6
Silica	22	21	8	8
Iron	0.05	0.02	0.01	<0.01
Boron	0.41	0.37	0.18	0.23
Fluoride	0.56	0.48	0.36	0.36
Iodide	0.01	0.03	0.01	0.01
Bromide	0.16	0.15	0.22	0.14
Tot. Kjel. Nitrogen as N	0.24	0.14	0.24	0.26
Ammonia Nitrogen as N	0.00	0.00	0.00	0.00
Nitrite " " "	0.002	0.000	0.001	0.001
Nitrate " " "	0.18	1.37	0.47	0.36
B.O.D. (5-Day)	1.1	1.0	1.4	0.8
Dissolved Oxygen	9.8	9.5	9.2	9.7
Carbon Dioxide	0	3	2	2
Carbon Chloroform Extract	0.042	0.033	-	0.105
Detergents MBAS	0.05	<0.05	<0.05	<0.05
Phosphate as PO ₄	0.19	0.12	0.02	0.01

* Parts per million

To help limit public access and incompatible land uses along the route of the Owens River Aqueduct, DWP leases out much of its 300,000 acres of land for pasture land, limited ranching and light agricultural crops such as alfalfa and grains. Intensive agricultural uses along the route have been discouraged.⁴

Water from the Colorado River is brought to the south-land by the Metropolitan Water District. This agency operates aqueducts, two treatment plants and a wide-ranging distribution system to supply water to its member cities or agencies. One treatment plant provides for softening as well as filtration; the other provides filtration only. Each plant provides chlorination.

Protection of the groundwater is vital. Water moves very slowly in its travel through the aquifer. Because of this slow travel, changes in water quality are not immediately apparent, but once occurring, are of long duration.

To achieve protection of the groundwater, it is necessary to exercise control over the discharge of waste materials on the watershed. This applies not only to the dumping or discharge of wastewaters, but also the disposal of solid wastes such as street sweeping and rubbish. The underground water is protected from solid waste dumps as well as from private and municipal wastewater discharges.

Cooperation between the various City Departments, adjacent cities and other governmental agencies, is exercised in an on-going program in the field of pollution prevention. This includes the geological study of proposed solid waste disposal areas, control by the City over the operation of the sites, and regulations to restrict the materials which can be put into a given site. Other potential sources of pollution include underground structures such as pipelines or tanks. This problem is evidenced by the gasoline leak near Forest Lawn in 1969. Continual monitoring of such systems is necessary to prevent future leakages.

⁴ Personal communication, G.A. Wyss, Assistant Chief Engineer of Water Works, Department of Water and Power, February 3, 1970.

Protection of Water Quality

California State Controls

The State Water Resources Control Board of the Resources Agency and the California Regional Water Quality Control Board, Los Angeles Region, have the responsibility of determining standards for the protection of the quality of water for all beneficial uses. Standards are established by the Regional Water Quality Control Board in its "Water Quality Control Plan (Interim)" and are adopted by reference in this report. Specific standards are intended to apply in the Conservation Plan concerning:

1. Ocean Discharge
2. Source Control and Pre-treatment
3. Discharge to Tidal Waters
4. Discharge to Bays
5. Discharge to Estuaries
6. Discharge to Fresh Waters
7. Discharge to Groundwater
8. Water Quality Objective for Surface and Tidal Waters
9. Water Quality Objective by the Los Angeles River
10. Water Quality Objectives by Solid Waste and Solid-Liquid Waste Disposal Sites
11. Water Quality Objective for Ocean Water
12. Temperature Objectives for Coastal Waters and Enclosed Bays and Estuaries
13. Discharge Prohibition
14. Water Quality Requirements for Water Discharge to Ocean Waters
15. Mass Emission Rates
16. Thermal and Elevated Temperature Discharge

Additionally, the Regional Water Quality Control Board has the responsibility for classifying solid waste disposal sites. However, the City Planning Department must still approve a Conditional Use Permit before these sites can be operative. The criteria used by the Regional Water Quality Control Board for classifying solid waste disposal sites are as follows:

Class I - Sites located on non-water - bearing rocks or underlain by isolated bodies of unusable groundwater, which are protected from inundation and where surface drainage can be restricted to the site or discharged to a suitable waterway, and where adequate safety exists to protect the potential radius of percolation.

Class II - Sites underlain by usable, confined, or free groundwater where the minimum elevation of the dump can be maintained above the anticipated high groundwater level. These sites should be protected from inundation which could occur from tides or floods having a predicted 100 year frequency. Surface drainage must be restricted to the site or discharged to a suitable waterway.

Class III - Sites where there is little or no protection to usable waters of the City.

On January 1, 1970, the Porter-Cologne Water Quality Control Act became operative. This act is the most comprehensive water quality control law in the nation and has far-reaching implications in the State's attempts to improve water quality.

Under the act, the various Regional Water Quality Control Boards are able to enforce discharge requirements directly without first showing existence of a condition of pollution or nuisance. If a discharge is taking place or anticipated to occur in violation of requirements, a regional board may issue a cease and desist order and request a time schedule for compliance. Violation of a board cease and desist order could result in a maximum fine of \$6,000 per day for each polluter.

Each state is required to submit its water quality standards to the Federal government for approval in compliance with the Water Quality Act of 1965. Once the standards submitted by a state have been approved by the Secretary of the Interior, they become Federal standards as well and are subject to Federal enforcement action.⁵ However, the initial responsibility for enforcement of the standards rests with the states. California's standards have received approval.

City Standards on Discharges

Regulations for chemical and industrial waste disposal in the City of Los Angeles are set forth in Section 94.20612 and 94.20305 of the Municipal Code. The Code requires that any chemical or industrial discharges likely to damage or increase maintenance costs of the public sanitary sewer system, detrimentally affect sewage treatment, or contaminate surface or subsurface water, should be pre-treated to render them innocuous prior to discharge into the public system.

5 "A Federal View of Water Pollution Control", Environmental Control Management, November, 1969, P. 23.

Quality standards are set by the California Regional Water Quality Control Board, Los Angeles Region. In addition, the Municipal Code provisions enable the Bureau of Sanitation to set the standards on certain industrial waste discharges.

The City requires that every industrial firm obtain a waste disposal permit; both the quality and quantity of waste discharges are monitored by the Industrial Waste Control section of the Public Works Sewer Maintenance Division. This ensures adequate protection of the public, the wastewater treatment process, physical facilities including sewers and storm drains, and maintenance personnel. This Plan envisions that environmental impact information will be required on the waste discharge; if the discharge would have a significant effect on the environment an Environmental Impact Report shall be prepared. Discharges other than to the wastewater system must meet water quality standards at least as stringent as those established for the receiving waters by the California Regional Water Quality Control Board, Los Angeles Region.

A monitoring program has been set up by the City and is paid for by industrial permits. Compliance inspections are performed by industrial waste inspectors. These technicians collect samples of the plant discharges and at key monitoring points on the sewer and storm drain systems and major tributaries, such as the Los Angeles River, Ballona Creek, and Dominguez Channel. Samples are analyzed by the City's Bureau of Standards. Those elements of waste discharges that will not be accepted into the wastewater system must be hauled away and receipted. In this way, the City has a measure of control over "bootleg dumping."

If the City standards are violated, monitoring may continue until the discharge again meets the requirements. Continued violation can result in the issuance of cease and desist orders and fines.

An example of a waste discharge that cannot be accepted into the City's wastewater system for treatment is brine. In the process of oil drilling on land, between 10% and 90% of the extraction is brine. The salt content of this fluid is so highly concentrated that it cannot be put into the wastewater or storm drain system or dumped into the ocean. It cannot be economically treated for disposal because of its toxicity to the treatment process and inorganic composition. Therefore, the City requires that the brine be put back into the ground.

Pollution Aspects of Urban Storm Runoff

Rain runoff is nature's way of carrying land detritus (loose material; debris) to the sea -- organic matter fertilized the ocean to make it productive and inorganic sand and silt formed the beaches. It was a never-ending continuum -- until man arrived on the scene to create urban areas, necessitating the construction of flood control projects.

According to the Bureau of Sanitation and County Flood Control District, the quality of Los Angeles storm water is fairly high. Flood control basins function as basic primary treatment plants: debris and catch basins trap large pieces of debris, and recharge areas along flood control channels settle out smaller particles. Therefore, the need to give storm water additional treatment for pollution control is questioned. To treat storm waters more fully will require additional capital expenditures for storage areas and treatment plants. Most of the currently existing dams were not built to hold water for long periods of time, but to level out storm peaks.⁶

Storm water components include chemical pollutants such as pesticides, herbicides, and fertilizers; street refuse such as wind-blown dust and dirt; coarse and crude matter; debris dropped by individuals; sidewalk sweepings; debris washed from vacant lots and elsewhere; building and demolition wastes; materials eroded from pavements. In addition, there is fall-out of air pollution particulates, asbestos from brake linings and particulates of tire treads, oil and gas leaks from automobiles, and so forth. Most of this runoff is discharged into Santa Monica Bay and the Los Angeles Harbor via the storm drain system.

The Federal Water Pollution Control Administration (FWPCA) found that the most significant component of street litter, in terms of producing water pollution potential by runoff, was dust and dirt. A weighted average in the test areas of dirt was 1.5 pounds per day per 100 feet of curb. Of this material, approximately three percent was found to be soluble and readily transportable. If a rainstorm occurs, the soluble portion is washed out in mass amounts. This soluble dust and dirt contains appreciable amounts of contaminants as nitrogen forms, phosphates, total bacteria counts, coliforms and fecal enterococci, all with high levels of Biochemical Oxygen Demand

6 Personal Communication, Louis A. Vita, Associate Civil Engineer Los Angeles County Flood Control District, April 3, 1970.

7 Federal Water Pollution Control Administration, United States Department of the Interior, and the American Public Works Association, Water Pollution Aspects of Urban Runoff, January, 1969, p. 3.

(BOD). These materials, as well as larger particles, enter storm drains and begin to decompose, producing a peak-flush phenomenon which can impose shock loadings on receiving waters. This shock loading could produce major oxygen depletion in the vicinity of storm water discharge points and in the surrounding area until adequate dilution took place. The result is that life forms are robbed of the oxygen they need to survive.

The use of pesticides, herbicides, and fertilizers has become a matter of increasing concern with respect to their content in urban storm water runoff. Two distinct problems are recognized: (1) many synthetic organic chemicals used for pest control or plant growth are extremely toxic, and (2) these chemicals resist degradation to less toxic forms. These detrimental chemicals are discharged into the ocean where they are subsequently assimilated in feeding processes. As a result, they become part of each succeeding step in the food chain, eventually reaching man himself.

Control of pollution effect of urban runoff must begin at the source. The pollution potential of street refuse after a rain can be minimized through the use of more sophisticated clean-up equipment and better municipal sanitation practices.

WATER RECLAMATION AND WATER RECHARGE

Waste Water Reclamation

Water has always been reused to some degree. The hydrologic cycle represents constant recycling: evaporation, rain, formation of streams or ground-water basins, usage, disposal, evaporation. The increased technology of waste water treatment techniques and the emphasis upon water conservation are two reasons for the increasing acceptance of the recycling or reclamation process.

As inland wastewater treatment plants are planned and constructed, consideration should be given to possible reuse or recycling of the effluent from these plants. Several factors affect the feasibility of water reuse. These include the mineral and biological quality of the effluent, its suitability for various reuses in terms of its quality, the cost of providing tertiary treatment as may be required, and possibly new methods or technology for specific types of treatment, as desalination.

Among the criteria that must be considered in selecting the location for a water reclamation plant are the following:

- . An adequate source or supply of wastewater.
- . A wastewater of a quality such that it can be treated by known processes to make it suitable for a given use.
- . A market or use for the reclaimed water where the total cost for treatment and delivery is competitive with other water sources.

Chapter 7, Article 4, of the Porter-Cologne Water Quality Control Act regulates the reclamation of water. Sections 13521 and 13522 of this Act assign the State Department of Public Health the responsibility of establishing criteria for each type of use of reclaimed water where the protection of public health is involved. It also has the duty of abating any contamination caused by the use of reclaimed water.

Section 13522.5 of the same Act requires that a report be filed with the appropriate Regional Water Quality Control Board by any person reclaiming, or proposing to reclaim water, or using or proposing to use reclaimed water for any purpose for which reclamation criteria have been established.

In establishing waste discharge requirements, the Regional Water Quality Control Board takes into account the quantity and quality of the effluent to be discharged, the quantity and quality of the receiving waters, and the beneficial uses to which the receiving water is to be put. The Board is guided in its decisions by the Interim Water Quality Control Plan established December, 1972.

The City has conducted numerous feasibility studies on the reclamation of wastewater and the development of treatment facilities. A comprehensive report entitled Reclamation of Wastewater - City of Los Angeles, (October 1968) was prepared by the Department of Water and Power in coordination with the Department of Public Works and the Department of Recreation and Parks. The feasible uses of reclaimed water, as given in that report, include:

- (a) Groundwater Recharge of Surface Spreading.
- (b) Seawater Intrusion Prevention in the West Coast Basin Barrier Project.

- (c) Irrigation and Lakes in the Sepulveda Flood Control Basin.
- (d) Irrigation and Recreation in Griffith Park.
- (e) Irrigation of Proposed Parks in the Santa Monica Mountains.

It is also worth noting that other uses were included in this study but were found to be infeasible, including:

- (a) Irrigation of freeway landscaping.
- (b) Groundwater injection in San Fernando Valley.
- (c) Cooling tower make-up supply at Valley Steam Plant.

In the near future, the Department of Public Works plans to construct at least two new plants for the treatment of wastewater. These are the Sepulveda Water Reclamation Plant and the Los Angeles-Glendale Water Reclamation Plant. Although designated as water reclamation plants, these are actually intended to provide secondary treatment to wastewaters at inland sites, thereby avoiding the construction of additional outfall lines to Hyperion, and the enlargement of the Hyperion Treatment Plant.

Both the Sepulveda and Los Angeles-Glendale Plants are to be located adjacent to the Los Angeles River Channel, which can be used to carry away the plant effluent. From the Sepulveda site, the secondary effluent will be of good quality, containing total dissolved solids (TDS) of about 500 mg/l, and is expected to be suitable for groundwater replenishment by spreading. (Total dissolved solids have a bearing on the "hardness" of water). The Department of Water and Power has proposed a short-term study to evaluate this use, including tertiary treatment requirements and the long-range effect on groundwater quality under large-scale operations.

The quality of secondary effluent from the Los Angeles Glendale Plant will have a somewhat higher TDS value than from Sepulveda. Glendale is planning to reuse a portion of its entitlement of this effluent for cooling water in its steam plant and a portion for cemetery irrigation. The City of Los Angeles is using the effluent for irrigation in the Griffith Park; it will also possibly be used for underground recharge by means of spreading grounds. The

Valley Settling Basin Plant, an experimental facility, is providing reclaimed water to Griffith Park under contract to the Department of Recreation and Parks. It is intended that this facility will ultimately provide reclaimed water at the rate of 25 million gallons daily (mgd) to the Park.

The Department of Water and Power and the Department of Public Works have coordinated their planning so that locations and facilities of the Department of Public Works wastewater treatment plants will provide maximum feasible opportunity to the Department of Water and Power for its subsequent water reclamation activities.

According to U. S. Department of Agriculture studies, a tertiary treatment plant with a capacity of treating 100 mgd costs about \$63.0 million to build and operating costs are about 14 cents per 1,000 gallons.⁸ This means an approximate cost of over \$45 per acre foot⁹ for a plant of this size. So, for purposes of direct usage it is more economical for the City to continue delivering fresh water through its existing facilities. However, since it is imperative that wastewater be treated, consideration of the reclaimed water for productive purposes should be given.

Possible Beneficial Uses of Reclaimed Water

- . Industrial Uses: Potential uses are cooling water, wash water, and process water. Firms that need vast quantities of water in their production processes include oil refineries, metal rolling mills, paper manufacturing plants, aggregate processing plants, steam power plants, chemical plants, and rubber manufacturing plants.
- . Agricultural Uses: The State of California and the United States Public Health Service have established strict standards on using reclaimed water on crops. The California Administrative Code, Title 17, Public Health, permits the use of primary treated effluent on nursery plants, cotton, and specified field crops that are not directly consumed by humans. In addition, dairy cows cannot have access to drainage

⁸ Biniek, Joseph P. Economics of Water Pollution Control Measures, p. 3.

⁹ An acre foot is sufficient water to cover one acre of land one foot deep -- a total of 325,850 gallons.

ditches carrying wastewater or effluent from the wastewater treatment plant or be allowed to pasture on the land while it is moist from effluent irrigation.

- . Recreational Uses: Parks and golf courses constitute large potential uses for reclaimed water. One of the attributes of reclaimed water is the generally higher level of nutrient value. The water quality requirements for reclaimed water to be used for recreational purposes, such as water contact sports and fishing, approach drinking water standards. Reclaimed water could initially be used in such places as Griffith and Elysian Parks for the creation of small ponds, lakes and streams for beautification purposes, but where no direct body contact sports are involved.
- . Ground Water Basin Recharge

There is a great potential in using reclaimed water for spreading operations. However, studies of the behavior of viruses and their movement in soil and ground waters have been remarkably few. Gaps remain in the fundamental understanding of how the soil functions as a filter and biological medium.

Results of investigations conducted by Stanford University indicate that virus movement through soils under saturated conditions and at the concentration normally found in domestic wastewater will present little or no hazard with respect to the contamination of water wells located upstream from the source of pollution, providing there is 100 to 150 feet of continuous strata of common soil containing no fissures between the pollution source and the well.¹⁰

Soil and water characteristics are the main influence in the distances that viruses can travel. The proximity of natural downstream wells should be considered when determining the suitability of locating spreading grounds for reclaimed water. A provision for monitoring the quality of ground water must be an integral part of any water reclamation project.

¹⁰ Eliassen, Rolf, et. al., Studies on the Movement of Viruses in Groundwater - Final Report, p. 1.

. Control of Salt Water Intrusion:

Freshwater production wells along much of the Los Angeles coast have been destroyed by seawater intrusion as a result of heavy inland pumping. This has lowered ground water levels far below sea level, necessitating the injection of fresh water to form a barrier. A barrier is created by injecting fresh water under pressure into the underground water producing zones. Through continuous injection, the fresh water blocks further seawater intrusion and also moves inland, raising groundwater levels and supplying production wells.

Water for use in the West Coast Basin Barrier Project is purchased from the Metropolitan Water District by the Central and West Basin Water Replenishment District. The Los Angeles County Flood Control District, under its conservation powers, operates and maintains the barrier facilities, including the pipeline and the injection wells. Imported Colorado River Water is also used in the Barrier Project. It is purchased at the groundwater replenishment rate, and, as such, is subject to interruption for a higher priority use. Other barrier projects include Alamitos and Dominguez Gap.

Tests are being made on the feasibility of using reclaimed water for injection purposes. As with ground water basin recharge, extensive tests and monitoring devices must be set up and maintained to insure that critical ground water supplies remain unpolluted, either from the cause of the problem (seawater) or as a result of the solution to the problem (reclaimed water).

. Direct Reuse of Reclaimed Water

The primary consideration with respect to domestic use of reclaimed water is that of public health.¹¹ Perhaps the greatest doubt regarding direct reuse of reclaimed water involves the reliability of the reclamation processes. Analytical techniques as well as automatic monitors that guarantee quality control have not yet been developed. If there is a minor interruption in a primary or secondary treatment plant, the implications for human health are not as serious as with an interruption in a tertiary plant. The plant must be operated so that the desired quality of reclaimed water is produced 100 percent of the time.

11 "On the Use of Reclaimed Wastewaters as a Public Water-Supply Source" should be consulted. This may be found in the Journal A.W.W.A., 63:490 (Aug. 1971).

Natural and Artificial Recharge

Water Recharge Areas

Generally, the entire San Fernando Valley floor making up most of the Upper Los Angeles River Area is a recharge area. Annually, the replenishment to the basin is approximately 50 percent from native waters (recharge from precipitation, runoff in the streams, and spread water) and 50 percent from water delivered and applied to lawns, etc. The return (deep percolation) from delivered water also includes approximately 10,000 acre-feet a year from cesspool recharge. The calculated safe yield from the ULARA is 104,000 acre-feet per year.¹²

To assist the replenishment to the ULARA, the Los Angeles County Flood Control District (LACFCD), and the Los Angeles City Department of Water and Power (DWP) maintain spreading grounds within the basin. The Department historically has spread both native and imported waters within the Headworks and Tujunga Spreading Grounds. In the future, the Department intends to continue spreading these waters plus water reclaimed from wastewater. The 1970-71 Watermaster's Report gives information on water supply and disposal within the ULARA.¹³ Included in this report are ground water contour maps and the location of the spreading grounds.

The LACFCD maintains four spreading basins within the ULARA. These spreading basins include the following: Branford, Hansen, Lopez and Pacoima. The native waters spread within these basins is a part of the safe yield of the ULARA.

The entire Valley fill of the ULARA is considered water bearing. The areas from which the City extracts ground water within the ULARA are primarily in the eastern portion of the San Fernando Subarea and the Mission Wells within the Sylmar Subarea.

12 Department of Water and Power, Personal communication, Toshio Mayeda, Principal Water Works Engineer, November 22, 1972.

13 State of California, The Resource Agency, Department of Water Resources, Watermaster Service, Bulletin No. 181-71 for period October 1, 1970 - September 1, 1971.

Criteria on Recharge

The Department of Water and Power and the LACFCD have extensive experience in the methods used in artificial recharge. Both agencies date back to the early 1930's in the experience of spreading of water for underground replenishment of the basins. The State Water Rights Board made a report on the San Fernando Valley for the period 1928-29 to 1957-58 on the water supply and disposal to the ULARA. The DWP and LACFCD's activities with the spreading of water are described in this report.

Methods and criteria for artificial recharge and control of seawater intrusion include:

(1) Natural recharge

Natural recharge occurs without assistance or enhancement by man. Natural recharge occurs when stream-flow infiltrates through a permeable stream bed or when rainfall infiltrates through the soils and percolates through permeable materials to the groundwater. Natural recharge also occurs when uncontrolled, tributary runoff infiltrates. Another type of natural recharge is the percolation of fresh water from adjacent permeable soils into the area of interest.

(2) Off-stream Spreading Facilities

Off-stream spreading facilities are those where water is diverted from a stream to allow it to infiltrate underground. One type uses the ditch and furrow method where water is distributed through a series of irrigation ditches as main laterals and by furrows into smaller laterals. Another facility uses levees to form shallow basins of about four feet in depth. These are usually called spreading grounds. Another can be a deep pit. These pits can be off-stream or in-stream.

(3) Enhanced Streambed Infiltration

Enhanced stream bed infiltration is different from natural recharge because some effort is made by man to increase the infiltration over what would otherwise occur. Such enhancement may be through such method as forming small levees formed on the river bottom, widening the channel or by drop structures which flatten the grade of the stream and cause the water to spread out rather than flow in a narrow channel.

(4) Runoff Impoundment

Runoff impoundment is another method of artificial

recharge. In this case conserving excess natural flows is the key item. Also in this category might be the impoundment of runoff which occurred because of cloud seeding operations.

(5) Reclaimed Wastewater and Non-Tributary Water

Reclaimed water is wastewater which has been given sufficient treatment to prepare it for some type of beneficial reuse. Non-tributary water is that introduced into a stream system from another watershed. For artificial recharge purposes, this water is normally infiltrated underground by using available spreading or injection facilities.

Water Resources - Riparian Rights Within the City

The City of Los Angeles is presently involved in the Courts of Appeal regarding its water rights within the ULARA. Los Angeles has always claimed, and previous court actions have confirmed, its Pueblo Water Rights regarding the ULARA. The Pueblo Right is superior to any and all riparian water rights. Los Angeles' Pueblo Water Rights claim all the water tributary to the Los Angeles River. This includes the Big Tujunga Creek waters plus all other tributary streams.

In the water litigation between Los Angeles and Glendale-Burbank in the 1930's, the Pueblo Water Right of Los Angeles was confirmed. A statement from Mr. Justice Traynor in that decision helps to clarify the nature of Los Angeles' Pueblo Water Right:

"It has long been established that as successor to the pueblo of Los Angeles, the city of Los Angeles has a right, superior to that of a riparian or an appropriator to satisfy its need from the waters of the Los Angeles River ... Because the flow of the river is dependent on the supply of water in the San Fernando Valley, it has also been held that the pueblo right includes a prior right to all waters in the basin ..."

PROTECTION OF WATERSHEDS, BEACHES AND THE OCEAN

Portions of the section on Water and its Hydraulic Force discuss some of the watershed problem. This section deals with some additional problems of watersheds and storm water runoff. It should also be noted that there are separate sections in this report dealing, in detail, with Harbors and Coastline Erosion.

Management of Watersheds - The City should preserve the maximum amount of open land possible in foothill and mountain areas. As a goal, it is hoped that 75-80% of the mountains can be preserved through selective clustering of development.

Better construction of stream water runoff drains and the improvement and expansion of spreading grounds promises an additional increase in the underground water supply. Experience has shown that heavy rainfall in the mountains create large debris flows, which in foothill areas can damage extensive areas. Construction of flood control basins in the main watershed provides a means of regulating flood flow discharges to minimize damage to the lower watershed. At the same time, conservation of water is provided through percolation into underground water reservoirs.

Debris basins trap much of the sediment content of runoff from the upper watershed. The clear flow, now of a lesser volume, spills into concrete lined stream channels to move swiftly to the ocean.

Submarine Outfall Disposal of Waste

Of the City's three treatment plants, the Hyperion and Terminal Island Plants are processing wastewater for disposal into the ocean. Ocean disposal has been the most economic method of getting rid of the City's waste flows. All cities and communities along the Pacific coastline use the ocean as dumping ground for wastewater. However, we have come to the realization that the ocean cannot assimilate limitless quantities of waste. The California Regional Water Quality Control Board, Los Angeles Region, has required the eventual cessation of ocean dumping of sludge. Rather than build more and more outfall systems, alternative methods of reducing the amount of wastes discharged into the ocean must be utilized.

Approximately 600,000 pounds of sludge are produced daily at Hyperion. Attempts have been made in the past to sell the sludge for use as fertilizer; however, the attempts were unsuccessful. Treated effluent and digested sludge from the Hyperion Treatment Plant are currently discharged into Santa Monica Bay via submarine outfalls. The effluent (liquid waste) outfall is five miles in length; discharge is in water two hundred feet deep. Two 4,000-foot diffuser legs at the end of the outfall contain many ports which provide mixing of the primary treated effluent with sea water so that the effluent remains submerged. Primary treatment removes the grease, floatable material, and concentrated settled solids.

Sludge (solid waste) receives secondary treatment and is then discharged at the head of a submarine canyon seven miles at sea, at a water depth of three hundred twenty feet. The design of the end of the outfall is such that the digested sludge is ejected into the shape of a plume. As a result, particles settle out over a wider area of approximately one-half mile in diameter. By the time the particles are ejected they are totally aerobic in nature; that is they do not demand oxygen for further decomposition.

The protection of public health is of prime consideration with outfalls. Standards of quality to be maintained in waters receiving treated discharges are set by the California Regional Water Quality Control Board. To assure that the City meets these standards, surf waters in Santa Monica Bay are tested daily at seventeen beach stations between Big Rock beach (14 miles north of Hyperion) and Malaga Cove (10 miles south of Hyperion). Bay waters are checked weekly at twenty-four offshore stations.

The City of Los Angeles has entered into a joint powers agreement with the Counties of San Diego, Orange, Los Angeles, and Ventura for a three-year Coastal Water Study to be completed in 1974. The purpose of this study is to identify how to best dispose of waste into the ocean, the detrimental effects of wastewater disposal, if any, and possible new design criteria for outfalls.

Operating agencies have no control or responsibility over study methods and results; five consultants have been hired to conduct the research independently of the sponsors. The researchers were selected from an ocean

institute in Massachusetts, the University of Hawaii, Scripps Institute of Oceanography, University of California at Berkeley, and a school in the Southern California area.

Bottom samples taken by the Bureau of Sanitation indicate that there has been no loss of species in the area affected by the dispersal of sludge. Others have grown in number, particularly a microscopic worm called Capatella. It is believed that this worm feeds upon the sludge nutrients, is in turn eaten and contributes to the food chain in this manner.¹⁴

There is no conclusive proof that sea life has been harmed by the discharges from the Hyperion Treatment Plant. Before we state categorically that ocean wastewater disposal is totally undesirable, we must have a fuller understanding of the marine population in the area over time.

Heated Water Discharges

Ecologists consider temperature the primary control of life on earth; fish, which are cold-blooded and unable to regulate their body temperature, are particularly sensitive to changes in the thermal environment. Each aquatic species becomes adapted to the seasonal variations in temperature of the water in which it lives, but it cannot adjust to the shock of abnormally abrupt change. For this reason, there is a growing concern among ecologists about the heating of aquatic habitats by man's activities.

Presently, there is insufficient knowledge to state, with certainty, that the effects of thermal discharge are always harmful. There are instances when it has been proven to be beneficial in stimulating organic productivity. Yet the potential for environmental damage exists; because of the potential hazard to life and to the balance of nature, the discharge of waste heat into the natural waters is coming to be called "thermal effect."

¹⁴ Personal Communication, Charles Imel, former Principal Sanitary Engineer, Bureau of Sanitation, City of Los Angeles, February 13, 1970.

Nuclear Power Plants

A nuclear steam supply system operates at a lower efficiency than does a modern fossil-fueled steam generator. In fact, a nuclear plant rejects about 40% more heat to the condenser cooling water than does a fossil-fuel plant of comparable power output. The rise in temperature of water as it passes through the condenser may be between 20° F. and 25° F. depending upon the design of the condenser. Water discharged from a comparable conventional steam plant has been increased in temperature 18°-22°F, but this is greatly diluted by receiving waters. Nuclear plants release an extremely small amount of radioactivity in their aqueous effluent, which has no counterpart in fossil-fuel plants. However, this amount is insignificant when compared to the natural background radiation. According to Glenn Seaborg, former Chairman of the Atomic Energy Commission, this radioactivity is released under carefully controlled conditions and at levels that are well below any that could possibly be considered hazardous to life.¹⁵

Ecological Implications of Increased Temperatures

There are critical temperatures above or below which fish will not reproduce. Temperature affects the longevity of fish as well as their reproduction. Allowing for maximum acclimation (which usually requires spreading the gradual rise of temperature over 20 days), the highest temperatures that most North American fishes can tolerate range from about 77°-97°F.¹⁶

The concern is not only with the abrupt temperature elevation that may cause immediate fish mortality, but with temperatures that are generally unfavorable. In the long run, temperature levels that adversely affect the animals' metabolism, feeding, growth, reproduction, and other vital functions will be as harmful to a fish population as outright heat death.

¹⁵ Seaborg, Glenn T., "Looking Ahead in Nuclear Power," Human Engineering, August 1969, p. 34.

¹⁶ Clark, John R., "Thermal Pollution and Aquatic Life", Scientific American, March 1969, p. 19.

Inasmuch as sea water provides the most economical means of condensing steam, Los Angeles has located three of the four City steam plants at coastal sites. The effect of heated sea water on marine life is not totally understood at the present time. Sea water discharge from a steam plant is elevated in temperature 18-22°.

At periodic intervals, the water discharge is restricted for about two hours to kill organisms and parasitic marine animals, such as mussels, growing in the outfall conduits. Intake pipes are subjected to the same process. The flow is reversed through the intake pipe until it rises in temperature, then it is reversed back to the discharge pipe. The process of restricting water flow is necessary to raise its temperature in order to dislodge these growths, as the growths would eventually decrease intake flow and increase pumping costs. For short periods of time during ejection, the temperature of the withheld water is elevated to about 105°F. at the discharge point.

The largest of the City's steam plants, the Haynes Steam Plant, is located along the San Gabriel River. Intake water comes from the Long Beach Marina in Alamitos Bay; discharge is made into the River. A study conducted several years ago indicated at that time that there had been no detrimental effect upon the San Gabriel Tidal Prism caused by discharge of the cooling water.¹⁷ Indications were that numbers of species had not been affected and that game fish had increased.

Various studies to determine the effects of discharges by the Scattergood Steam Plant into Santa Monica Bay have also shown negligible effects, if any, on marine life surrounding the outfalls. Water temperatures were taken from 1958-59 to 1964 at various depths to 25 feet below the surface at points approximately 300 feet from the discharge point.¹⁸ The greatest degree differential between surface temperatures and those at 25 feet below the surface was four to five degrees, or 60°-65° F.

¹⁷ Personal Communication, H.J. McWhirter, Power Design and Construction Division, Department of Water and Power, March 5, 1970.

¹⁸ Personal Communication, H.J. McWhirter.

Recently, Marine Advisers, Inc. were consulted to ascertain the effect that additional heat loading created by Scattergood Power Plant No. 3 would have upon the receiving waters of Santa Monica Bay. A total of 110 species or distinct groups were recorded.¹⁹ Sportfish landings data indicated that the variety of species had increased in the area around Scattergood over time and it is possible that the plant's operations had contributed to this change.²⁰ This is an effect that may, in the long run, actually improve sportfishing conditions in the Bay. Data on effects of discharge by the Harbor Steam Plant were unavailable.

Current operations of the Department of Water and Power are in accordance with standards and procedures set down by the California Regional Water Quality Control Board, Los Angeles Region. Studies, to date, have not shown any deleterious effects of heated water upon marine life. However, composition of the marine life population is unpredictable if additional amounts of heated cooling water are discharged into offshore waters. Some animal species may decline and be replaced by others more tolerant to the new environment.

If direct discharge into ocean waters is unavoidable because of economic reasons, then it is strongly urged that power plants discharge an effluent of moderate temperature well offshore, below the ocean water surface. In monetary terms, it will be more expensive for a plant to build a longer and deeper outfall, but the subsequent heat discharge should have a lesser deleterious effect upon aquatic resources. The warm water plume would serve to draw nutrient-rich water from depth, thereby stimulating organic productivity.

New methods of construction using closed circulating systems and the use of cooling devices can be required for future power plants or industrial firms using cooling water. However, cooling towers are expensive; they represent an added cost of from \$7-27 per kilowatt. The total cost of a one-million kilowatt plant is \$100.0-\$130.0 million. A cooling tower would add from \$7.0-\$27.0 million to this cost, depending on the type selected, with the closed-circuit type being the most expensive.²¹

¹⁹ Marine Advisers, Inc., The Marine Environment Offshore the Los Angeles Department of Water and Power Scattergood Generating Plant, January-February 1970 Survey, p. 14

²⁰ Ibid., p. 52

²¹ Cairns, Jr., John, "We're in Hot Water", Scientist and Citizen, October, 1968, p. 193.

Sea farming may offer the best hope of someday providing a needed outlet for waste heat. Pilot studies now in progress in Britain and the United States are showing better growth of fish and shellfish in heated waters than in normal waters, but no economically feasible scheme has yet emerged.²²

Status of Harbor Waters

The engineering staff of the Harbor Department is aware that there are water quality problems that must be solved. Pollution problems were recognized as far back as 1949 when Harbor officials were instrumental in urging the County District Attorney to hold public hearings on industrial waste discharges tributary to the Harbor. These hearings led to the establishment of the first State Water Quality Control Board in 1953.

In a decision reached on October 16, 1969 the Los Angeles Regional Water Quality Control Board designated marine life as a beneficial use for the Inner Harbor and ordered a rise in dissolved oxygen standards to protect it. (See also discussion in Chapter IV, Fisheries).

Related Programs

Federal installations such as Naval shore bases and ships have long been conspicuous offenders in polluting Harbor and coastal waters. The State Water Quality Control Board has issued orders to local installations to clean up their waste discharges. As a result, Fort MacArthur is now in compliance with Board requirements and the Navy in Long Beach has begun projects totalling about \$1.0 million which will solve its waste discharge problems.

Ship waste cannot be discharged into the wastewater system because of its salt water content. Therefore, discharges continue to be made into the Harbor. At the present time this is not being controlled; no State or Federal regulations exist to enforce water quality standards upon these ships.²³ About 80% of the vessels in the Harbor are foreign-constructed; there are no treatment plants or holding tanks aboard them. It has been estimated that it would take two to five years to install holding tanks on vessels calling at the Port

²² Clark, *op. cit.*

²³ Personal communication, Nereus L. Richardson, Associate Water Quality Control Engineer, State of California, Resources Agency, Los Angeles Regional Water Quality Control Board, December 5, 1972.

and the cost would run from \$50,000 to \$100,000 a ship.²⁴ Because of the international implications involved in requiring foreign flag vessels to meet City standards on waste disposal, Harbor officials feel that this problem should be resolved on a national level through a system of Federal standards and regulations, perhaps derived after negotiation with foreign governments.

Oil spills in the Harbor are systematically and expeditiously cleaned up. It is required that spills be reported immediately to the Coast Guard by the offending ship captain, and the ship's line is responsible for all clean-up costs. If an immediate report of a spill is not made, a fine is levied on the ship. Each gallon of spilled oil depletes the oxygen content in 400,000 gallons of sea water.²⁵ As more and larger tankers enter the offshore area, the potential for oil spill disasters and their deleterious effects will increase tremendously.

High standards of navigation and piloting skill can make a significant contribution toward the prevention of collisions and groundings of vessels in coastal waters and harbors. One recently-passed Congressional bill now requires the licensing of tow-boat pilot personnel. Another step was passage of a Coast Guard Bill that took effect January 1, 1973, requiring the use of bridge-to-bridge telephones between vessels, domestic and foreign, entering port.²⁶ Under the Ports and Waterways Safety Act, July 10, 1972, the United States Coast Guard establishes rules and regulations for the protection of ports and coastal areas, vessel traffic systems, waterfront safety zones, and provides for the promulgation of regulations increasing safety standards of vessels. These improvements in communication between the pilots on approaching vessels of all types, regulation of traffic systems, and higher standards of piloting skill can make a significant contribution toward reducing casualties which could result in the pollution of waterways.

²⁴ Ruhlow, Jerry, "Delay Sought on Ordinance to Bar Harbor Pollution". Los Angeles Times, February 19, 1970.

²⁵ Newsweek, November 27, 1972, p. 74.

²⁶ Personal communication, Commander Janicik, Waterway Safety Branch, U. S. Coast Guard, December 6, 1972.

SUMMARY AND CONCLUSION

The Water Section of the Conservation Plan has been prepared to conform to Section 65302 of the California State Government Code. Accordingly, the Plan includes sections dealing with water and its hydraulic force, including rivers and other waters, water resources and quality, wastewater reclamation, water recharge, and the protection of watershed, beaches, and the ocean.

The Water Resources portion of this Plan adopts by reference the policies, program standards and criteria of the Water System Plan, Drainage System Plan, Sewerage Plan, Open Space Plan and other Plans which are under preparation and which affect the City's water resources. This Plan provides a greater degree of specificity into individual facility standards and requirements and watershed protection.

The State of California has preempted all local jurisdictions with respect to water quality, both on land and in the ocean. Its control is exerted through the various regional boards of the State Water Quality Control Board. Water quality standards are set and prescribed by law.

The main concern of the Water Resources Section of the Conservation Plan is to preserve and conserve the supply and quality of all water resources of the City. Programs are recommended to reduce pollution from all sources and to restrict development when hazardous conditions warrant. Environmental Impact Reports are required for any projects, or areas, where there is danger of polluting or contaminating the City's water resources. Protection of the Coastal Zone and the ocean for their beneficial uses are key elements of the Plan. Research into alternative uses for waste sludge now deposited in the ocean is also recommended.

The Conservation Plan advocates the maximum feasible conservation of water by utilizing reclaimed wastewater; recapture of stormwater runoff, as practicable, consistent with protection of life and property; and minimization of the impact of additional flood control projects. It is also felt that there is a need for the creation of a regional water resources management committee or association dealing with all water resources on a coordinated basis.

The Water Resources Section has concerned itself with water pollution of various types, and has considered the purity of water supplies, wastewater disposal, water reclamation, industrial wastes, heated water discharges, inland water recreation, the Los Angeles Harbor, and flood control. Current problems in each of these areas have been discussed and programs have been surveyed through which pollution may be minimized. A managed and controlled utilization of water resources is essential to the economic well-being of the City. Detrimental environmental effects, both short and long run, of such utilization must be alleviated wherever feasible. Much remains to be done if the high quality of Los Angeles water is continually to be assured.

CHAPTER II

FORESTS

There are 3,484 acres of National forest land within the boundaries of the City of Los Angeles: 2,639 are under direct control of the U. S. Forest Service and 845 acres are privately-owned. There have been a number of private structures permitted on public land on a lease basis and all lessees have had to comply with local zoning and permit requirements. Presently, there are no vacant cabin sites available in the Angeles National Forest and creation of new lots has been discontinued.

The Angeles National Forest was established to protect the watershed that supplies the Los Angeles basin with its ground water and to reduce the danger of floods. Only within the last twenty years has the Forest Service considered recreation as a major purpose of the forest.

The major urban impact upon the forest is the threat of fire. A joint powers agreement exists among the Forest Service, the City and the County for mutual fire protection and aid in the event of fire. All owners of private property that backs up to the Angeles National Forest are required to clear brush within 100 feet of any structure, not the property line. That is, if a structure is located within 50 feet of the property line, the Forest Service is required to clear 50 feet of its land on the other side. According to the Department of Fire, the 100 foot requirement has been adequate in the vast majority of fire cases.

Presently, all that is required by ordinance is brush clearance; however, fire protection should not stop with clearance. Clearance alone can set up problems of soil erosion, which could conceivably turn into a major earth slide problem with the first rain. There are sufficient types of fire retardant plants available and involved property owners should be required to replant the areas with these types of materials.

When the time to the rainy season is short, quick growing ground cover plants must be planted as soon as possible. This can be followed after the rainy season by the planting of more permanent and slower growing fire retardant plants. A listing of approved ground covers for both erosion control and fire retardancy is available from the Department of Building and Safety.²⁷

²⁷ Guide for Erosion and Debris Control in Hillside Areas,
November, 1970

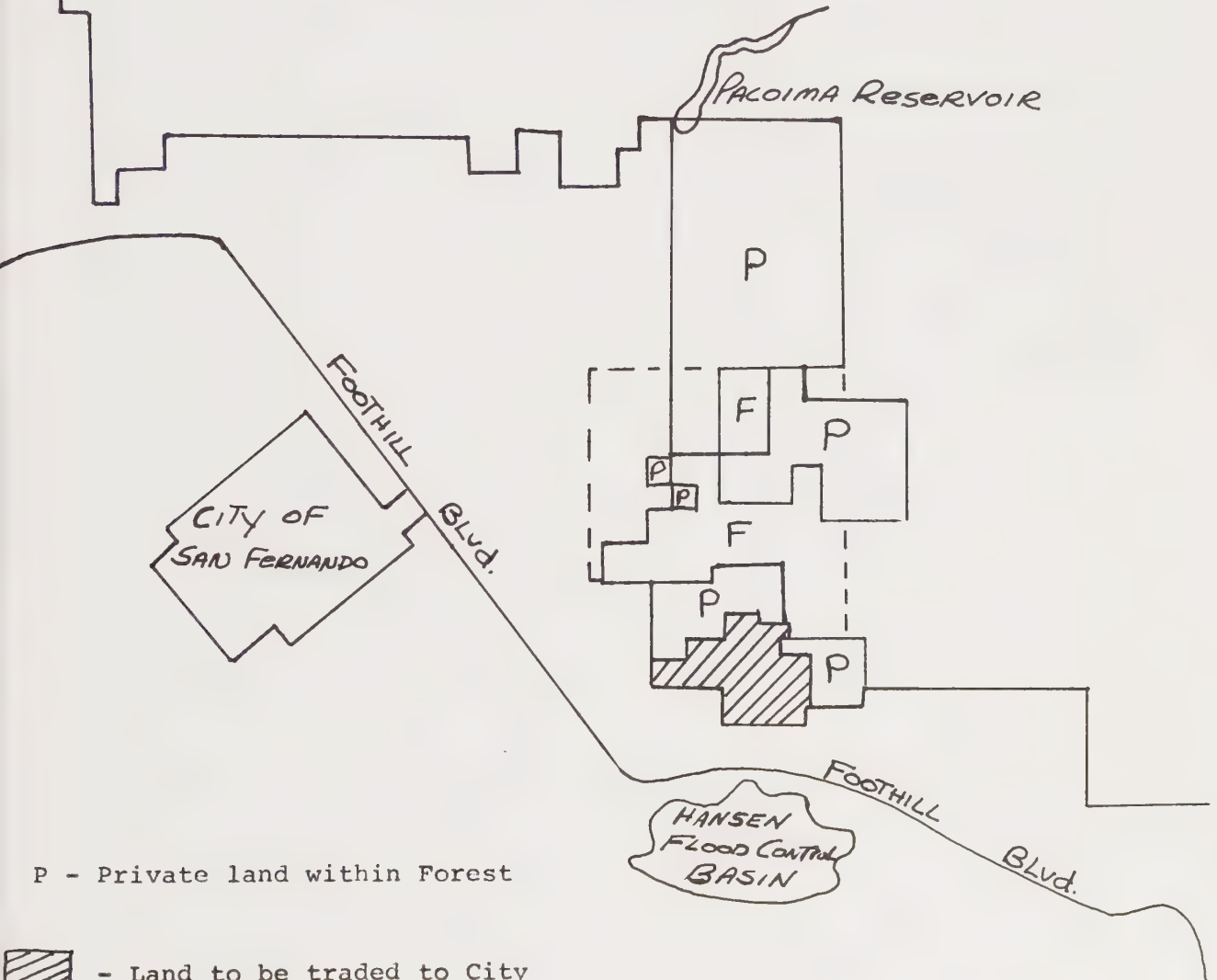
Forest lands contained within the City are somewhat of a hodgepodge ownership, with mixtures of public and private land. For purposes of protection and control, the Forest Service desires to release its ownership on some of its land to try and firm up its boundaries to exclude as much private land as possible. For this reason, the Forest Service is now negotiating with the City for a trade of approximately 217 acres, which will be utilized by the City as a sanitary landfill. The parcels are indicated on Fig. 3. In return, the Forest Service will obtain lands from the Department of Water and Power in San Francisquito Canyon.

The Planning Department Staff understands the reasoning behind this type of policy; however, suggests that it be modified with respect to the Big Tujunga Wash area, as designated on the Map of Ecologically Important Areas. Not only is the Wash area significant in terms of ecology, it would serve the two major forest functions: reducing the danger of floods and providing additional recreational opportunities. Development could be controlled, thereby reducing the need for vast amounts of tax dollars being put into flood control projects. Therefore, the Staff recommends that the U.S. Forest Service take the necessary steps to include the designated area within its boundaries.

Likewise, there are other open areas adjacent to presently established forest boundaries that have similar physical characteristics, making them likely candidates for incorporation. Areas within the Verdugo and Santa Susana Mountains and Simi Hills have little development in them, have a high degree of recreational potential, and may be considered fire hazard areas if development is not adequately controlled. The City should encourage the Forest Service to consider the feasibility of incorporating some or all of these areas. A greater degree of coordination between City personnel and the Forest Service will be necessary to accomplish mutual goals.

Figure 3

ANGELES NATIONAL FOREST



P - Private land within Forest

 - Land to be traded to City for landfill

----- Eventual Forest land to be traded to public agencies or private individuals

CHAPTER III

SOILS

Proper use of soils and recognition of their limitations and capabilities should be basic in a land-use planning program. Soils are an important natural resource which may be properly utilized, or wasted and destroyed. Soils and their capabilities, along with climatic factors, are instrumental in determining where economic agricultural activities can or should take place. They also determine what the natural vegetation may be, where structures may be safer for occupancy, how effective septic tanks may be, where applied or natural-occurring water may reach ground water basins, or where water will be held near the surface.

The Soil Conservation Service of the United States Department of Agriculture has mapped general soil groups of Los Angeles County, from which the groupings within the City of Los Angeles have been extrapolated. A general soil map is a small-scale map delineating different geographic areas and showing the patterns of soils that occur within each area. Soils with similar characteristics are grouped together; each area on the map is called a soil association and is named for the major soil series it contains.

General soil maps are suitable only for general program planning. They are no substitute for detailed surveys but have a very useful purpose when available at the proper time in the planning process.²⁸ Individual interpretations can only be made from more detailed surveys. The soils of most urbanized areas have been altered by much cutting and reshaping of the landscape. These areas are shown on the general soil map as the soil pattern was presumed to be before urbanization.²⁹

As a result of urbanization, the prime agricultural soils of the City, i.e. those with high fertility, virtually have all been covered. From a natural resource point of view, urbanization represents a misuse of the maximum soil capabilities of these areas. From the economics of construction such prime soils are generally the ones most desirable for subdivision. As a result, there is little agricultural land that can be conserved on a long-term basis and remain viable. Development pressures, for the most part, are too great. Such agricultural uses as do exist within the City on privately-owned land, i.e., orange or olive groves, corn fields, strawberry patches, nurseries, etc., should be considered as an interim use of the land. Levels of soil fertility are shown on the map, Inherent Soil Fertility.

²⁸ U.S. Department of Agriculture, Soil Conservation Service, Report and General Soil Map, Los Angeles County, California.

²⁹ Ibid p. 6

Various soils and soil groups are naturally more susceptible to erosive agents than others. Table 2 indicates the erosion hazard for the soil associations located within the City. In combination with slope, activities such as road construction, changes in water drainage and increasing water run-off may tremendously accelerate erosion processes and cause extensive damage to the natural environment.

Ignoring certain types of human activities may create erosion problems for various areas where previous threat by erosion agents was minimal or nonexistent. Such an activity is off-road vehicle use, which destroys valuable vegetation cover, allowing the erosion process by wind and water to have maximum effect.

As indicated in the Erosion Hazard map, the areas which face the most severe erosion hazard are the beach areas along the Santa Monica Bay and a number of areas in the San Fernando Valley, including Universal City, Studio City and Sherman Oaks. The involved areas in the San Fernando Valley are characterized by soils of an association with slopes of 30 to 75%. Less serious but significant erosion problems are found in Eagle Rock and Highland Park, which is characterized by soils with slopes of 9 to 30%. The only other areas in the City with a relatively high erosion rating are found in the western portions of the San Fernando Valley, including an area generally bounded by Van Nuys, Pacoima-Sun Valley, Chatsworth and Canoga Park. It is these areas in which maximum care must be taken in the design and construction of storm drains and flood control networks, so as to minimize the disruption of drainage patterns and volumes which may exacerbate existing and serious erosion problems.

Construction of roads and building sites in areas naturally susceptible to erosion agents, such as in especially steep areas, creates situations that will have negative results unless proper controls are placed upon these activities. The public interest is not served when such activities take place in areas known to be highly susceptible to erosion.

Roadbuilding and Soil Erosion

Of all the activities associated with urban development, the construction of roads has the most serious impact on the soil mantle. Although most erosion occurs during construction when soil is exposed, significant erosion from cuts, fills, roadsides, culverts, and downstream areas can continue indefinitely if proper controls are not administered.

TABLE 2

TABLE OF SOIL CHARACTERISTICS AND QUALITIES

GROUP I - SOILS OF THE ALLUVIAL FANS, PLAINS AND TERRACES

MAP SYMBOL	SOIL NAME	POSITION	NATURAL DRAINAGE	SUBSOIL PERMEABILITY	RUNOFF	EROSION HAZARD	EFFECTIVE DEPTH (INCHES)	INHERENT FERTILITY	PRESENT LAND USE
1	Oceano association 2 to 5 percent slopes, wind eroded	undulating dune-like areas	excessive	rapid	very slow	moderate to high wind	60	low	urban
2	Tujunga - Soboba association, 0 to 5 percent slopes	nearly level and gently sloping alluvial fans	somewhat excessive to excessive	rapid to very rapid	slow to very slow	slight to moderate wind	60	low to very low	urban
3	Hanford association 2 to 5 percent slopes	gently sloping alluvial fans	well	moderately rapid	slow	slight	60	moderate	urban
4	Yolo association	gently sloping alluvial fans	well	moderate	slow	slight	60	high	urban few crops
5	Cropley association	nearly level alluvial plains and valley floors	well	slow	very slow	slight	60	high	urban
6	Foster-Grangeville association	nearly level alluvial plains and alluvial fans	poor to somewhat poor	moderate to moder- ately rapid	very slow	slight	60	moderate	urban
7	Chino association	nearly level valley floors	somewhat poor	moderately slow	slow	slight	60	high	urban
8	Ramona - Placentia association, 2 to 5 percent slopes	gently sloping terraces	well	slow	slow	slight	60	moderate to low	urban few orchards

9	Ramona - Placentia association, 5 to 9 percent slopes	moderately sloping terraces	well to moderately well	slow to very slow	medium	moderate	60-18	low	urban few orchards
10	Ramona - Placentia association, 9 to 15 percent slopes	strongly sloping and rolling terraces	well to moderately well	moderately slow to very slow	medium to rapid	high	60-9	moderate to low	urban
GROUP II - SOILS OF THE UPLANDS									
11	Pleasanton - Ojai association, 2 to 9 percent slopes	gently sloping to moderately sloping alluvial fans and terraces	well	moderately slow	slow to medium	moderate	60	low	urban
12	Calleguas - Arnold association, 30 to 50 percent slopes, eroded	steep mountains	well to somewhat excessive	moderate to rapid	rapid	very high	8-36	low	range watershed wildlife
13	Gaviota-Millsholm association, 30 to 50 percent slopes	steep mountains	well to somewhat excessive	moderate to moderately slow	rapid	high	10-20	low to moderate	watershed wildlife
14	Hambricht - Gilroy association, 15 to 50 percent slopes, eroded	moderately steep and steep mountains	well	moderate to moderately slow	rapid	high	8-40	moderate	watershed wildlife
15	Vista - Amargosa association, 30 to 50 percent slopes, eroded	steep mountains	well to excessive	moderately rapid	rapid	high	14-38	low to very low	range wildlife watershed

16	Diablo - Altamont association, 2 to 9 percent slopes	gently sloping to rolling foothills	well	slow	medium	slight	22-52	high	urban
17	Altamont - Diablo association, 9 to 30 percent slopes, eroded	strongly sloping to medium steep hilly areas	well	slow	medium to rapid	moderate to high	20-39	high	urban watershed wildlife
18	Altamont - Diablo association, 30 to 50 percent slopes, eroded	steep hilly to mountainous areas	well	slow	rapid	high	20-39	high	urban watershed wildlife
19	San Andreas - San Benito association 30 to 75 percent slopes, eroded	steep to very steep mountains	well	moderate to moderately slow	rapid to very rapid	high to very high	24-48	moderate to high	watershed wildlife range

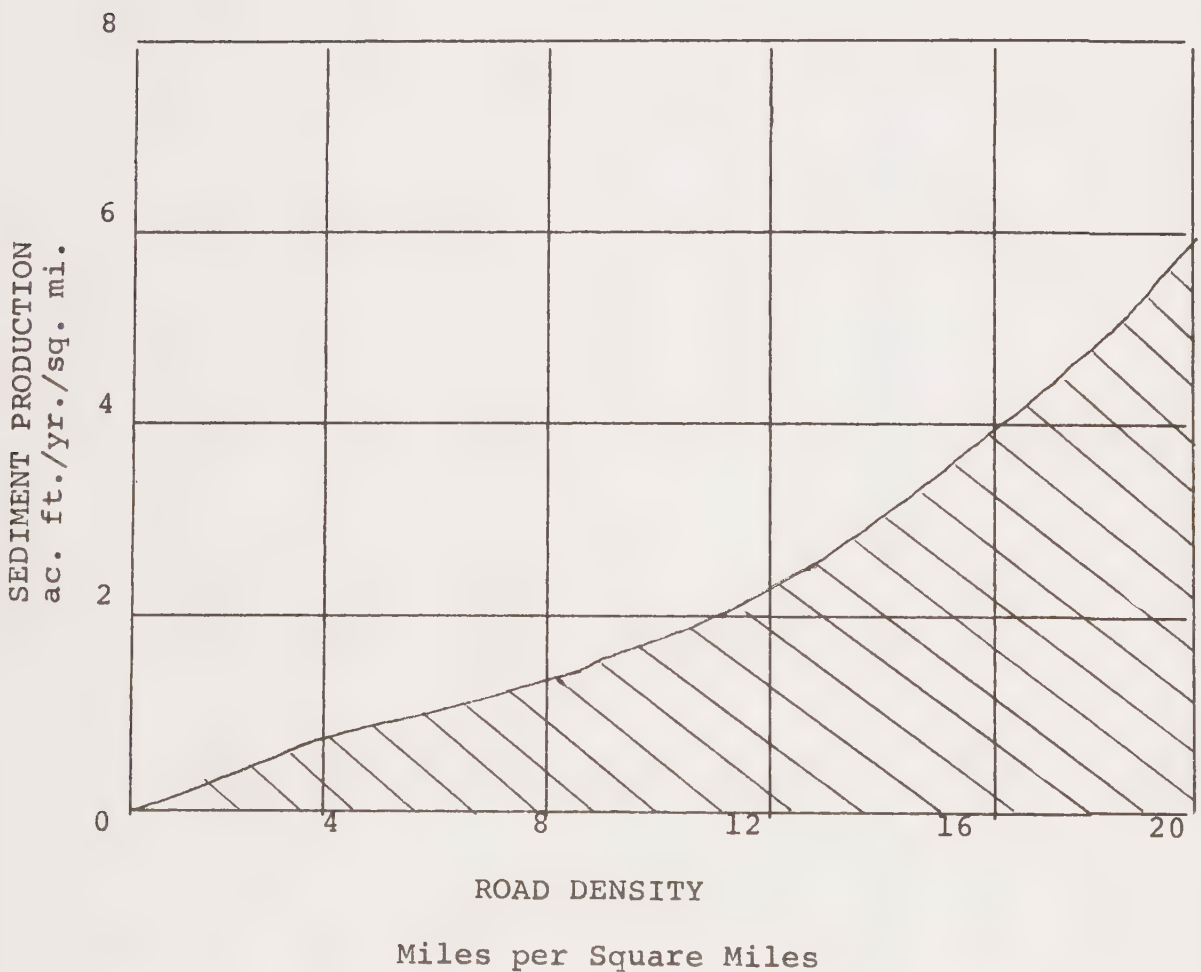
GROUP III - MISCELLANEOUS LAND TYPES

20	Beaches	coastal beaches	variable	very rapid	slow	very high	60	very low	recreation
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SOURCE: United States Department of Agriculture, Soil Conservation Service Report and General Soil Map, Los Angeles County, California, December, 1969.

Road densities (miles of road per square mile) have an effect on total erosion greater than proportionate densities would indicate. Doubling the road density more than doubles erosion. Activities such as subdivisions, with high road densities, greatly increase the potential for soil erosion.

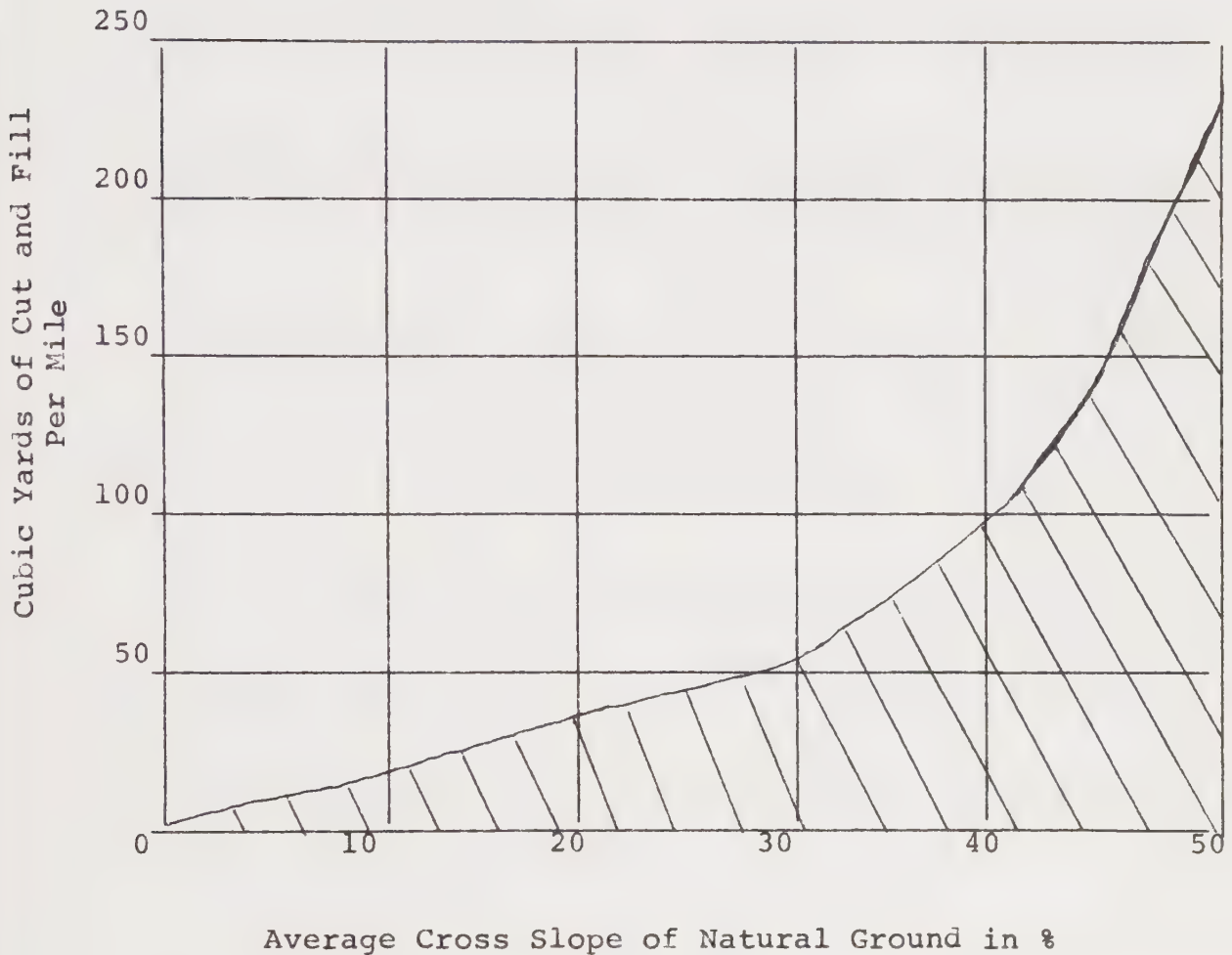
Figure 4
Relationship Between Road Density
and Sediment Production



SOURCE: State of California, The Resources Agency, Department of Conservation, Division of Soil Conservation, Environmental Impact of Urbanization on the Foot-hill and Mountainous Lands of California, November, 1971, p. 20.

Steep slopes result in higher cuts and longer fill slopes with greater areas exposed to erosion.

Figure 5
Quantity of Cut and Fill Required Per Mile of
Road on Hillsides



SOURCE: Ibid., p. 24.

Division 30 of the Los Angeles City Building Code describes the erosion control and drainage devices required in hillside areas. These controls include storm drains and desilting basins. With the proper utilization and application of designated devices, flows of mud or silt can be trapped before they do great damage.

Runoff Volume

Decreases in the amount of land area available for the absorption of stormwater in the urban environment necessitates the construction of artificial means of stormwater retrieval, namely a system of storm drains and flood control channels. While this allows the urban area to escape the more dramatic impact of storm water flows, such as widespread flooding, it also modifies the runoff pattern from the natural flow which preceded urbanization.

The pervious alluvium of the foothills, significant ground water recharge areas for valley aquifers, are silted by sediment from urban development activity, which reduces its recharge capability. Urbanization occurring directly on important recharge areas diminishes percolation into the water table.

Studies by the U. S. Army Corps of Engineers have shown that the degree of imperviousness may vary from about 20 percent in low-density residential areas to about 90 percent in commercial land use areas. The following table lists the percentages of impervious areas that are considered typical for a given land use:

PERCENT OF IMPERVIOUSNESS IN URBAN AREAS³⁰

<u>Land Use</u>	<u>Percent of Impervious Area</u>
Low-Density Residential	20-30
Medium-Density Residential	25-35
High-Density Residential	30-40
Business/Commercial	40-90
Light Industrial	45-65
Heavy Industrial	50-70

Watershed Problems

A change in the natural condition of the watershed, i.e. removal of some or all of the natural vegetation, leads to an increased amount of runoff water, which leads to the necessity of constructing extensive flood control or storm drain projects.

³⁰ Loc. cit. p. 43.

Public acquisition of partial watersheds is an example of the need to maintain the supervision of the vegetative cover on the upper watershed in order to protect lands and vegetation that would be damaged lower in the same watershed.

On occasion, consideration must be given to the ultimate effect that conserving one resource will have on the effect of conserving another. For instance, plans have been made to utilize a certain portion of the reclaimed water output from the Glendale Reclamation Plant for irrigating sections of Griffith Park. This is a wise use of the reclaimed water; however, studies should begin to determine what the exact entitlement should be in terms of assimilation capacity of the soils and the prevention of adverse impacts because of subsequent ecological changes. As indicated by Table 2 and the map, vast sections of the Park may be subject to high or very high soil erosion hazard, and slope stability may be questionable in some locations. Therefore, before large quantities of water are indiscriminately pumped into the Park, limits on water should be established to preclude the undermining of slopes or the introduction of detrimental ecological changes.

Table 3 indicates additional characteristics of soils found in the City with respect to their relationship to development. Although the erosion potential may be the most important factor to consider, other soil qualities can also have an effect on any construction that occurs upon them.

Highly erodible soils can become unstable with cutting and filling and may be susceptible to earth slippage and mud flows. If water absorption by the soil is poor, there will be a high degree of surface runoff during rainstorms which can cause severe erosion. Bedrock close to the surface can also result in a similar drainage problem. Corrosive soils will contribute to chemical action that can damage or destroy underground cables. Shrink-swell soils swell when wet and shrink when dry, thus providing an unstable base for road beds, underground pipelines and building foundations. Any structures on this soil type therefore require extra reinforcement. Soils with steep slopes do not in themselves preclude the construction of buildings, but extra precautions must be taken in such areas to prevent erosion or slippage.

The definitions of soil ratings used in Table 3 follow. In all instances, the criteria and descriptions are those of the Soil Conservation Service.

HYDROLOGIC SOIL GROUPS

Hydrologic soil groups³¹ are used for estimating the runoff potential of soils on watersheds. Four groups are used, based on soil properties that influence runoff. Classification is made at the end of long-duration storms, after prior wetting and opportunity for swelling has occurred, and without the protective effect of vegetation.

Criteria:

Group A: Soils having high infiltration rates even when thoroughly wetted, consisting chiefly of moderately-deep to deep, moderately-well to well drained soils with moderately-coarse textures. These soils have a high rate of water transmission and would result in a low runoff potential.

Group B: Soils having moderate infiltration rates when thoroughly wetted, consisting chiefly of moderately-deep to deep, moderately-well to well drained soils with moderately-coarse textures. These soils have a moderate rate of water transmission.

Group C: Soils having slow infiltration rates when thoroughly wetted, consisting chiefly of (1) soils with a layer that impedes the downward movement of water or (2) soils with moderately-fine to fine texture and a slow infiltration rate. These soils have a slow rate of water transmission.

Group D: Soils having very slow infiltration rates when thoroughly wetted, consisting chiefly of (1) clay soils with a high swelling potential, (2) soils with a high permanent water table, (3) soils with claypan or clay layer at or near the surface, and (4) shallow soils over nearly impervious materials. These soils have a very slow rate of water transmission.

³¹ United States Department of Agriculture National Engineering Handbook, "Hydrology," Section 4. Soil Conservation Service, as reprinted in Report and General Soil Map, Los Angeles County, California, December 1969.

Shrink-Swell Behavior

Shrink-swell behavior is that soil quality that determines its volume change with change in moisture content. The volume change behavior of soils is influenced by the amount of moisture change, amount and kind of clay in the soil. In general, the soil with the largest clay content shrinks and swells the most; however, the kind of clay may be more important in some cases than the amount. Much damage to building foundations, roads and other structures may be the result of shrinking and swelling of the soils. The ratings of shrink-swell potential indicate the volume change resulting from the shrinking of the soil when it dries and the swelling of the soil as it takes up moisture. Three degrees of limitations are used: low, moderate, and high.

Corrosivity for Untreated Steel Pipe

Soil corrosivity of buried steel pipe is dependent upon the physical, chemical and biological characteristics and qualities of the soil. Three degrees of limitations are used: low, moderate and high. They are based on soil properties such as texture, drainage, permeability, total acidity, and electrical resistivity of the soil.

Limitation Rating for Allowable Soil Pressure

Soils are classified on their ability to withstand pressure imposed on them by foundations, as defined in LAMC Table 28-A, Los Angeles Building Code. In all cases, except for rock, allowable soil pressure is determined for a foundation one foot in width at a minimum depth of one foot, below adjacent virgin ground. The surface foot of soil is not considered in rating the soil. Three soil limitations based on the soil texture and dry consistence are used: slight, moderate and severe.

Limitation Rating for Excavation

The presence of cobbles, stones, rock or a water table in the surface five feet of soil has considerable effect on the excavation of soils for pipelines, roads, channels or other engineering construction. Soft or weathered rock can be excavated easily with commonly used earth-moving equipment. Gravel may be present in any amount without affecting the ease of excavation. Three degrees of limitations are used: slight, moderate and severe.

Limitation Rating for Septic Tank Filter Fields

The septic tank filter field is a part of the septic tank absorption system for on-site sewage disposal. It is a subsurface tile system laid in such a way that effluent from the septic tank is distributed with reasonable uniformity into the natural soil. Criteria and standards used for rating soils are made on the basis of soil limitations. Sodium salts from water softeners and other sources tend to disperse the clay in the soil and reduce the effectiveness of the filter field. Coarse textured materials may allow contamination of ground water supplies with such materials as detergents. Three degrees of limitations are used: slight, moderate, and severe. These ratings assume the minimum depth of earth cover over lines is 12 inches. The minimum diameter of lines is four inches. The minimum filter material over lines is two inches. The minimum filter material under the lines is 12 inches.

Limitation Ratings for Water-Retention Structures

The suitability of undisturbed soils for use as water-retention structures such as irrigation reservoirs, fish ponds, stockwater ponds, and recreation lakes. This requires separate ratings of soil for two functions:

1. As a floor for impoundment areas, and
2. As a source of embankment material.

Soil features of interest are those which relate to water tightness of the impoundment area and embankment and the stability and safety of the embankment. Three limitation ratings are used: slight, moderate, and severe.

Stability as a Source of Sand and Gravel

Soil is rated as a source of construction material for use in concrete plaster, mortar and aggregate. Groupings are generalized and are not intended to eliminate the need for on-site sampling and testing of material for specific engineering work and uses. Gradation and quality of materials are not considered. Accessibility of source and depth to water table are not considered. Four suitability ratings are used: good, fair, poor, and unsuitable.

TABLE 3

INDEX OF SOIL INTERPRETIVE GROUPINGS

GROUP I - SOILS OF THE ALLUVIAL FANS, PLAINS, AND TERRACES

MAP SYM- BOL	SOIL NAME	HYDRO- LOGIC GROUP	SHRINK SWELL BEHAVIOR	CORROSIVITY FOR UNTREATED STEEL PIPE	ALLOWABLE SOIL PRESSURE	EXCAVA- TION	SEPTIC TANK FILTER FIELDS	WATER RETENTION STRUCTURES		SOURCES OF	
								<u>FLOOR</u>	<u>EMBANKMENTS</u>	<u>SAND</u>	<u>GRAVEL</u>
1	Oceano Associa- tion, 2-5 percent slopes, wind eroded	A	low	low	severe	slight	slight	severe	severe	good	unsuitable
2	Tujunga-Soboba association, 0-5 percent slopes	A	low	low	severe	slight	slight	severe	severe	good	unsuitable- fair
3	Hanford associa- tion, 2-5 percent slopes	B	low	low	moderate	slight	slight	severe	moderate	fair	unsuitable
4	Yolo association	B	moderate	low	moderate	slight	moderate	moderate	moderate	unsuitable	unsuitable
5	Cropley Assoc.	B	high	high	slight	slight	severe	slight	moderate	unsuitable	unsuitable
6	Foster Grangeville association	C B	low	high to moderate	moderate	severe to severe moderate		severe	moderate	unsuitable to poor	unsuitable
7	Chino association	C	moderate	high	moderate	moderate	severe	slight	moderate	unsuitable	unsuitable
8	Ramona-Placentia association, 2-5 percent slopes	C D	high	moderate	moderate	slight	severe	moderate	slight	unsuitable	unsuitable
9	Ramona-Placentia association, 5-9 percent slopes	C D	high	moderate	moderate	slight	severe	moderate	slight	unsuitable	unsuitable
10	Ramona-Placentia association 9-15 percent slopes	C D	high	moderate	moderate	slight	severe	severe	slight	unsuitable	unsuitable

(CON'T)

11	Pleasanton-Ojai association, 2-9 percent slopes, eroded	C	moderate	low to moderate	moderate	slight	severe	moderate	moderate to slight	unsuitable to poor	unsuitable
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GROUP II - SOILS OF THE UPLANDS

12	Calleguas-Arnold association, 30 to 50 % slopes, eroded.	D A	low	moderate to low	moderate to severe	severe to slight	severe	severe	severe	moderate to severe	unsuitable to fair	unsuitable
13	Gaviota-Millsholm association, 30 to 50 % slopes.	D	low to moderate	low	moderate	severe	severe	severe	moderate	unsuitable	unsuitable	
14	Hambright-Gilroy association, 15 to 50 % slopes, eroded.	D C	moderate	moderate	moderate	severe	severe	severe	moderate	unsuitable	unsuitable	
15	Vista-Amargosa association, 30 to 50 % slopes, eroded.	B C	low	low	moderate	severe	severe	severe	moderate to severe	poor to unsuitable	unsuitable	
16	Diablo-Altamont association, 2 to 9 % slopes.	D	high	high	moderate	moderate to severe	severe	moderate	moderate	unsuitable	unsuitable	
17	Altamont-Diablo association, 9 to 30 % slopes, eroded.	D	high	high	moderate	severe	severe	severe	moderate	unsuitable	unsuitable	
18	Altamont-Diablo association, 30 to 50% slopes, eroded.	D	high	high	moderate	severe	severe	severe	moderate	unsuitable	unsuitable	
19	San Andreas- San Benito association, 30 to 75 % slopes, eroded.	B C	low to moderate	low to moderate	moderate	slight	severe	severe	moderate to slight	fair to unsuitable	unsuitable	

GROUP III - MISCELLANEOUS LAND TYPES

20	Beaches	D	low to variable	low to variable	slight to variable	severe to variable	severe	severe	severe to variable	unsuitable	unsuitable
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GRADING AND SOIL USE

Landslides

A landslide is a mass of natural rock, soil, artificial fill, or a combination of these materials that has moved under the force of gravity from its previous position on a slope. Landslides take place under the influence of geologic, topographic and climatic factors. Seldom is the slide caused by a single factor, although a single factor, such as improper grading, may be the one that results in the final failure.³² A distinction must be made between the basic cause and the trigger. It is the basic cause that must be eliminated in order to forestall further failure.

Water usually has a major role in causing landslides. Water flowing over the surface of the land erodes, steepens, and undercuts slopes, thus removing lateral support and causing an increase in stress on the earth materials underlying the slopes.³³ The hills fringing Los Angeles are composed of stratified earth and rocks which contain shale layers. These shales are firm if dry, but slippery when wet. If the soil becomes oversaturated, the ground is likely to begin moving, as the weaker layers fail.

The Need for Controls

During the 1950's, the City experienced severe problems with geologic catastrophes: land failures and subsequent mud flows. Inadequate controls over hillside development were deemed to be the cause. As a result, a drastically amended grading ordinance passed into law in 1963 which set the angle of slopes for hillside development at 2:1 (horizontal: vertical), but made provision for variances if individual geologic reports could substantiate creating a steeper slope, i.e., 1-1/2:1. The full text of the ordinance can be found in the City Building Code, Division 30 and Rule of General Application No. 5-67 in the Appendix section of the Code.

32 The Mayor's Ad Hoc Landslide Committee. Landslide and Attendant Problems p. 33.

33 State of California, The Resources Agency, Landslides and Subsidence, p. 14.

At the same time of the adoption of the grading ordinance, two resolutions, Nos. 635 and 636, were adopted by the Board of Building and Safety Commissioners.³⁴ Resolution No. 635 deals with the supervision of hillside tract grading and is an attempt to fix the responsibility of the various professions engaged in this type of work. Resolution No. 636 deals with hillside subsurface exploratory work and is an attempt by the Department to insure that adequate sub-surface exploratory work is done for all proposed hillside grading projects.

Site Evaluation

The Southern California environment is hostile and tricky; some areas in the mountains may be safer on which to build than parcels in the flat lands, but this cannot be guaranteed in advance. Tests of each hillside building site must be made prior to the issuance of building permits. The procedures followed by qualified engineering geologists and soils engineers in their site investigations generally include:

- Review of existing maps and reports to compare the geology and topography of the site with the regional setting.
- Detailed geologic mapping of the site and adjacent areas to locate and observe rock types and their distribution and the types and approximate dimensions of soil and landslide deposits. Mapping is done through direct observation on the ground surface and aerial photos. Although decisions cannot be made on maps alone, mapping has resulted in increased recognition of slides and causes of many slides so that areas of questionable stability can be predicted and controls instituted.
- Subsurface exploration through trenches or borings.
- Laboratory tests to determine the strength and other physical characteristics of soil and rock.
- Analysis and report preparation to provide specific conclusions and recommendations after study has been made of field and laboratory data and geologic samples.

34

The Mayor's Ad Hoc Landslide Committee, op. cit., p. 48.

These investigations, thorough though they may be, do not end upon the report's completion. As work progresses on a grading project, unanticipated adverse conditions may make themselves known and corrective measures may have to be designed. A final report must be submitted to indicate that all grading and foundation conditions are satisfactory.

Other provisions of the 1963 ordinance include requirements for improved drainage devices, scientific landscaping, irrigation, and setbacks for building adjacent to slopes.

Results of the 1963 Ordinance

The first major test of the ordinance came after the severe storms of January-February, 1969. An assessment of the damage indicated that 5% of the total damage sustained in the City was due to landslides, 95% was the result of erosion, mud and debris flows.³⁵

As of March 18, 1969, a breakdown of sustained damage to hillside sites indicated the following:

	<u>Construction Period</u>		
	<u>Pre-1952</u>	<u>1952-1962</u>	<u>1963-1969</u>
Structural damage	\$1.0 million	\$.4 million	\$ 5,300
Soils -			
Natural & Graded	2.3 million	2.4 million	177,000
Number of			
Hillside Sites	10,000	27,000	11,000

According to the Department of Building and Safety, the damage to post-1963 hillside developments was only 3% of the total, yet 13% of all hillside homes in Los Angeles were built since 1963.³⁶ Also, recent hillside developments are in steeper terrain.

³⁵Personal communication, Charles Yelverton, Geologist, Department of Building and Safety, April 21, 1970.

³⁶Schoustra, Jack J. and Thomas D. Lake, "Los Angeles Hillside Developments Put to Test by Recent Rains", Civil Engineering, November, 1969, p. 40.

During and after the rains, several meetings were held between City and County building officials, practicing soil engineers, and engineering geologists. The general consensus was that the present grading ordinance is adequate from a safety standpoint to prevent catastrophic damage to modern hillside developments.³⁷

The problem of the correction of landslides and the damage they cause is difficult to solve. Recent court decisions have lain fault not only with the contractor, but the financial institution making the project loan. This is the result of the assumption that the institution should have a knowledge of the geology involved before it makes a loan on the property. To minimize City involvement in terms of monetary responsibility, the Building Code requires a surety or cash bond based upon the number of cubic yards of material in either excavation or fill to be filed before a grading permit is issued.

The Federal Government is in the process of working out implementation details for mudslide insurance. The City submitted the map of the delineated hillside areas (as defined in the Appendix of the Building Code) as the eligible areas in which such insurance would apply.

Over the years, the City has become a more active participant in the prevention and correction of landslides. Problems of earth movement have reached major significance in Los Angeles, and they are not expected to decrease in the future. Geologic hazards are difficult to deal with; there are many variables that will enter into estimating as to whether or not a specific parcel will slide. Safety standards set for one lot may be totally irrelevant when development occurs around it.

But one thing is clear -- one of the major functions of city government is to protect the lives and property of its citizens. Adequate inspection of developments providing for rigid enforcement of standards and code provisions must take place. This Element recommends that the Department of Building and Safety be staffed with sufficient personnel to perform in-depth and continued on-site inspection of grading projects.

Although the primary concern is safety, the time has come to attach importance to more sophisticated and subtle impacts of the 1963 Grading Ordinance. Residents of surrounding developments should not have to be subject to inordinate

³⁷Ibid, p. 41.

inconveniences, noise from dynamiting, inadequate control over dust formation and the like. The Element strongly suggests that another look be taken at the 1963 Ordinance to upgrade its esthetic considerations.

Citizen Responsibility

A contributing factor to the landslide problem is that the individualistic nature of the hillside dweller does not lend itself to community protective action. Thorough investigations, detailed development planning, and competent construction practices can all help insure that hillside home properties will be developed with a reasonable assurance of stability. However, the resident must be aware that it is incumbent upon him to maintain the property in a manner that will assure continued stability. All drainage devices must be kept clean and in good repair. Care must be exercised in the watering of yards to avoid oversaturation of the ground or creating excess runoff. A complete inspection of hillside property should be made periodically by the property owner and drainage deficiencies should be looked for and corrected prior to each rainy season.

CHAPTER IV

FISHERIES

Geologic structure, geographical location, and biologic evolution have combined to make the sea off Southern California one of the truly unique and productive fishery areas of the world. A variety of habitats are present: estuaries, mudflats, sand beaches, bays, rocky shores, kelp beds, shelves, submarine canyons, basins, troughs, and islands.³⁸ Although the coastline of the City of Los Angeles does not contain all of these elements, the effects of actions taken within the City affecting the marine environment will not be isolated to include only the habitats along our shore.

Normally, the ocean water is extremely fertile and will support highly productive marine communities. The diversity of habitats offers opportunities for the existence of a tremendous variety of organisms. Artificial changes in the marine environment, while perhaps having had no adverse effect upon the fertility of the waters, have drastically altered the habitats to the extent that some species of marine life have become seriously endangered as a result.

BAYS AND ESTUARIES

Natural bays and estuaries are normally among the most densely populated and productive of the marine habitats. When left unaltered, mudflats are self-fertilizing ecosystems because of the intermittent exposure of the surface to the air on low tides. This daily exposure permits the nitrogen fixing process to take place.

An abundant supply of food in a continually fertile area provides a comparatively high carrying capacity for animal life which may be present on a perennial or seasonal basis depending upon the particular species under consideration. Fish use estuaries as reproductive or nursery grounds. Many species of birds also use them as nesting or wintering grounds.

³⁸Fay, Rimmon C. et al, An Evaluation of the Health of the Benthic Marine Biota of Ventura, Los Angeles and Orange Counties, p. 43.

Dredging of a natural estuary to build marinas or a harbor results in the removal of the mudflats and the fundamental ability of the water to produce the fertilizers that are required for abundant plant life. This is not to say that a harbor cannot function in part as an estuary; harbors are not designed to retain the natural biologically productive functions found in an estuary.³⁹

If the harbor receives an input of waste materials, the productivity of the system will be reduced even further and may even become abiological. Such a situation existed in Los Angeles Harbor until the State Regional Water Quality Control Board placed strict controls on industrial waste discharges tributary to the Harbor.

Inventory and Status

Santa Monica Bay

The Bay is protected by law from commercial fishing activities but there are four landings from which sport fishing party boats emanate. Additionally, there is extensive recreational fishing off piers. Some of the species of sport fish which may be found in the Bay include rockfish (residence fish) and the migrators: halibut, white croaker, kelp and sand bass, mackerel, bonito, barracuda, and white perch. Even though the Bay has a protected status, biologists and fishermen have not noted any apparent increase in stocks of fish.

The major reason generally given for this condition by marine biologists is the pollution of Bay waters emanating from the City's wastewater disposal at the Hyperion Treatment Plant and the County Sanitation Treatment Plant at Whites Point. A trawl study was conducted in Santa Monica Bay during 1958-63 by the California Department of Fish and Game. It was hoped that information on the occurrence and distribution of bottom-fish in this area would reveal the effects of waste disposal on their populations. In all, 705 bottom tows in 60 to 600 feet of water yielded 112,799 fish of 104 species. Five species made up the bulk of the catch. There was a moderately high yield of fish per ton in 1958, an extreme low in 1959, a build-up in 1960, a high in 1961, and a moderate drop in 1962 and 1963.⁴⁰ The sport catch for the years 1958-63 in Santa Monica Bay showed only small fluctuations.⁴¹ No trend was apparent.

³⁹ Ibid, p. 55.

⁴⁰ Carlisle, Jr., John G., "Results of a Six-Year Trawl Study in an Area of Heavy Waste Discharge: Santa Monica Bay, California", California Fish and Game, January, 1969 p. 28.

⁴¹ Ibid.

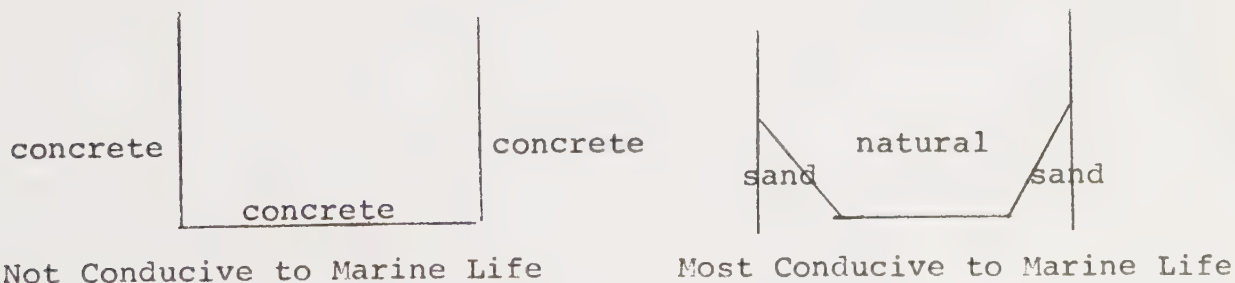
The results of the study could not prove that catch fluctuations were due to waste discharge and not to natural causes. The data accumulated in this trawl study will be compared with recent trawl information gathered by the Southern California Coastal Water Research Project (SCCWRP), an independent research organization created through a joint powers agreement including the City of Los Angeles and the Counties of San Diego, Orange, Los Angeles and Ventura. Analysis and comparisons will be made of the data with respect to species assemblage, diversity and disease incidence.⁴² Also, preliminary analysis by SCCWRP suggests the possibility of a relationship between bottom dissolved oxygen concentrations, which are low in summer, and the distribution and abundance of marine fish in Santa Monica Bay. The final outcome of the SCCWRP study will be to determine whether or not waste discharge has a detrimental effect upon fish abundance.

Venice Canals

The Grand Canal parallels the Marina peninsula and extends about one mile into Venice and forms a network of shallow canals. A productive clam bed exists at the entrance of the Grand Canal and a number of fishes periodically wander into the channel system, but there is no other apparent permanent marine life in the canal system. Heavy growths of algae and some ditch weed occur on a seasonal basis.

The entire canal system is intended to be drained, deepened, and rebuilt in the near future. (The City has prepared an Environmental Impact Report on the Venice Waterways Project.) It is highly conceivable that the variety of marine life can be increased, providing that the canal bottom is left natural and the sides of the canals are not constructed upright and concreted.⁴³ The following is a pictorial representation:

Figure 6



⁴²SCCWRP Progress Report, p. 4.

⁴³Personal communication, Robert Vile, Ocean Fish Protective Association, November 22, 1972.

Rubble in the form of rocks or broken concrete could be scattered on the canal bottom to reintroduce benthic organisms that are the food supply for larger fishes. The additional tidal action that would be supplied by widening the entrance channel would be of aid in keeping marine life alive.

Del Rey Lagoon and Mudflats

The Del Rey Lagoon has a surface area of about five acres. It has functioned periodically as a nursery for fishes but such use has been prevented as a result of heavy poisoning of the Lagoon, presumably to control plant growth. Some water fowl are present in the area. A saltmarsh near Ballona Creek has been identified by the County Environmental Resource Committee as an ecologically important area because it is one of the last vestiges of salt marshes in the County. (See Chapter VI.)

Los Angeles Harbor

Until 1970, water quality in the Harbor was managed in a manner that eliminated all forms of marine life in order to protect the timber pilings from destructive boring organisms. To replace these pilings would have been economically disastrous. Recently, however, a way was found to wrap the pilings very tightly in vinyl film; as a consequence, little or no oxygen is left around the pilings to support life. All new pilings are constructed of pre-stressed concrete and are not affected by boring organisms that may return as water quality increases.

In a decision reached on October 16, 1969, the Los Angeles Regional Water Quality Control Board designated marine life as a beneficial use for the Inner Harbor and ordered a rise in dissolved oxygen standards to protect it. Five milligrams (mg) of dissolved oxygen per liter is the minimum capable of supporting desirable fish life. The Board felt that the objective of 5 mg/l could be achieved in the Inner Harbor by January, 1973, if proper industrial sewer service is provided for the Harbor by the City of Los Angeles.

The current water quality standards permit no toxic industrial waste discharge directly into Harbor waters; these are diverted into the County Sanitation District treatment plan at Whites Point and then into the ocean off Palos Verdes. Fish cannery wastes are sent to the Terminal Island Plant for treatment. Presently, wastewater flowing into the Terminal Island Plant is given only primary treatment before being discharged. Although treatment capacity is expected

to increase to 28 million gallons daily during the 1972-73 fiscal year, the treatment will still be only of the primary variety. The earliest point at which secondary treatment may be available is 1975. (Primary treatment only removes the grease, floatable material and concentrated settled solids.)

Within the last two years water quality in the Harbor has improved markedly. Water has become clear to depths of 8 to 10 feet, odor is disappearing, and oxygen levels as high as 8 parts per million have been recorded.⁴⁴ Diverse marine life that normally inhabits clean water is returning to the inner harbors, where oxygen readings up to 15 ppm have been taken.

The Harbor may still be considered a nursery ground for such commercially important species as perch, halibut and rockfish. The main bait fishery in the Los Angeles area exists in the Harbor and consists of Northern anchovy. According to the Resources Agency, State of California, the Harbor complex has supplied up to 95 percent of the live bait needed by California's ocean sport fishery. The 1965 California Fish and Wildlife Plan states that shore, ocean and bay fisherman spend approximately \$36 million annually in Los Angeles County; a high percentage of this is spent within the Harbor area.⁴⁵ The State feels that the anchovy live-bait fishery is a vital component to this use of marine resources and its elimination would have serious consequences on sport fishing.

As policies designed to upgrade water quality are effectively implemented, water quality in the Harbor can be expected to continue to improve. Some uncertainty exists about the future of the Harbor as a marine habitat, however, since proposed development plans will seriously encroach upon those habitats now just beginning to reestablish themselves. Any actions that may fill habitat areas or decrease tidal flow into the Inner Harbor will run counter to all activities designed to clean up waste discharges and will obliterate the life current policies are designed to save. Important policy decisions will have to be made with respect to permitting the Port to attain its ultimate development and the economic benefit this development portends for citizens of Los Angeles on the one hand and preserving the integrity of Harbor waters for recreation and fishing on the other.

⁴⁴Sheehan, Joe, "Back from Perdition", Outdoor California, 1971.

⁴⁵U.S. Army Corps of Engineers, Preliminary Draft Environmental Statement, Los Angeles - Long Beach Harbors, November 1972, letter of comment by Resources Agency, State of California, Unpublished.

ROCKY SHORES

Rocky shores offer an increase in the number of niches available to organisms by increasing the number of surfaces to which they can adhere. Rocky shores or rock features on the shoreline are of both natural and artificial origin along the coastline; those close to the City of Los Angeles are primarily of the latter nature, in the form of groins, jetties, and breakwaters.

Rocks at any depth are a natural attractant for fishes. In fact, any large solid object on the bottom, such as sunken boats or automobiles, will attract fish. A broad variety of organisms can attach themselves to rocks or solid objects, creating food sources for other biota, thereby establishing a highly productive marine habitat.⁴⁶

Inventory and Status

Santa Monica Bay

One large assemblage of rocks at a depth of 150 feet may be found in the center of Santa Monica Bay off the Del Rey-Manhattan Beach shoreline.

Artificial rock clusters are present near the Santa Monica Breakwater, but because of the generally poor water quality in the Bay, do not seem to accommodate a healthy marine biota.

Cabrillo Beach - Los Angeles Harbor

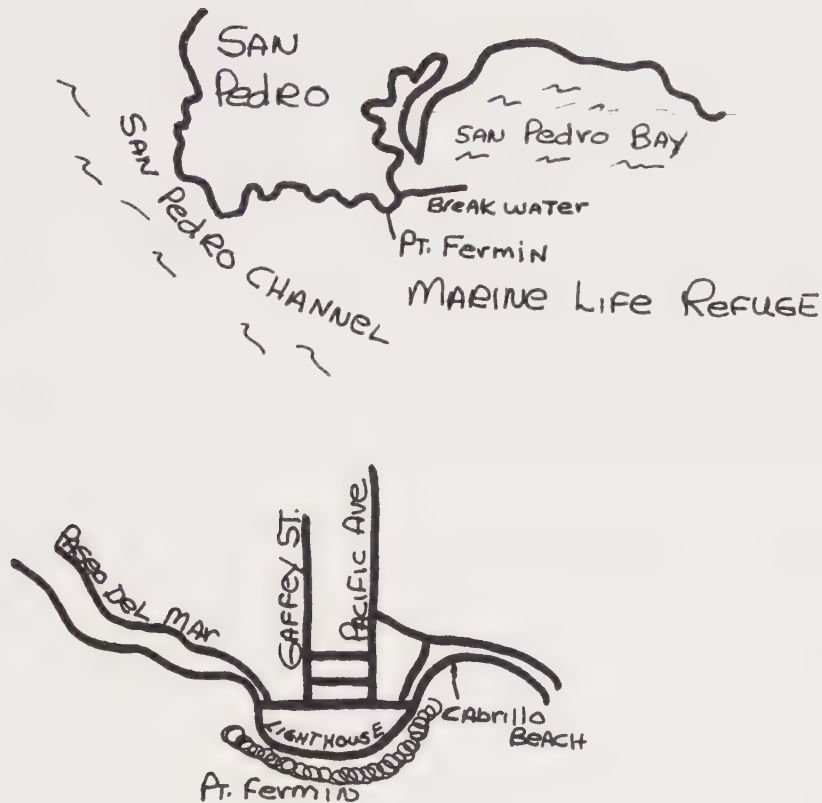
An isolated rock plateau exists about 5 miles offshore of Point Fermin and supports fishing activity for sportsmen. Species of fish caught within the harbor waters have been identified above.

The area adjacent to the Cabrillo Beach Museum at Point Fermin (Fig. 7) has been certified by the State of California as a Tidepool Refuge. Approximately 400-500 school children are taken on tours of the area by volunteer guides and Museum personnel.⁴⁷ To minimize impact upon the biomass, tours are rotated; one section of the tidepool area is utilized while other sections are allowed to rest undisturbed.

⁴⁶It has been suggested that one method of disposing of many junked autos is to assign them for permanent disposal in the ocean to serve as "apartment houses" for fish. (Eventually they might rust away, but plenty of replacements are available.)

⁴⁷Personal communication, John M. Olguin, Director, Cabrillo Beach Museum, Department of Recreation and Parks, City of Los Angeles, November 29, 1972.

Figure 7



POINT FERMIN MARINE LIFE REFUGE

Source: Emil J. Smith, Jr. and Thom H. Johnson, The Marine Life Refuges and Reserves of California, California Department of Fish and Game, Marine Resources Information Bulletin No. 1, Plate 7.

KELP BEDS

Kelp beds of Macrocystis pyrifera manifest the natural fertility and productivity of the waters of the coast of California wherever rocks are present at shallow depths (0-100 feet) and water quality permits the algae to survive. In ecological terms, a kelp bed may be 100 times more productive than an adjacent sand bottom; however, the functional role of the

forests of this algae extends beyond the expression of the fertile nature of the inshore waters. Kelp beds exert a breaking influence on wave surges and thus act as a stabilizing factor to retard the erosion of the shoreline. The forests offer refuge for fish which require this protection as a nursery ground for their young and as a cover for escape from predators. The kelp itself is food for those organisms which graze upon this plant (abalone, crabs, snails, sea urchins) and harbors smaller organisms that are basic components of the food chain for larger fishes. The kelp holdfast (root-like anchoring structure which holds the plant in place) is the home of a variety of nearly every sort of creature, including protozoans, sponges, hydroids, anemones, flatworms, ribbon worms, bryozoans, amphipods, isopods, annelid worms, crabs, barnacles, snails, chitons, octopuses, starfish, brittle starfish, cucumbers, tunicates, fish, and algae.⁴⁸ In terms of overall value to the inshore area, kelp beds, where they occur, would locally account for a minimum of 90% of the amount of living matter (biomass) of those areas.

Macrocystis is an important renewable resource of California, for it is harvested to provide a source of algin for a broad range of applications in food, cosmetics, and coatings.

Inventory and Status

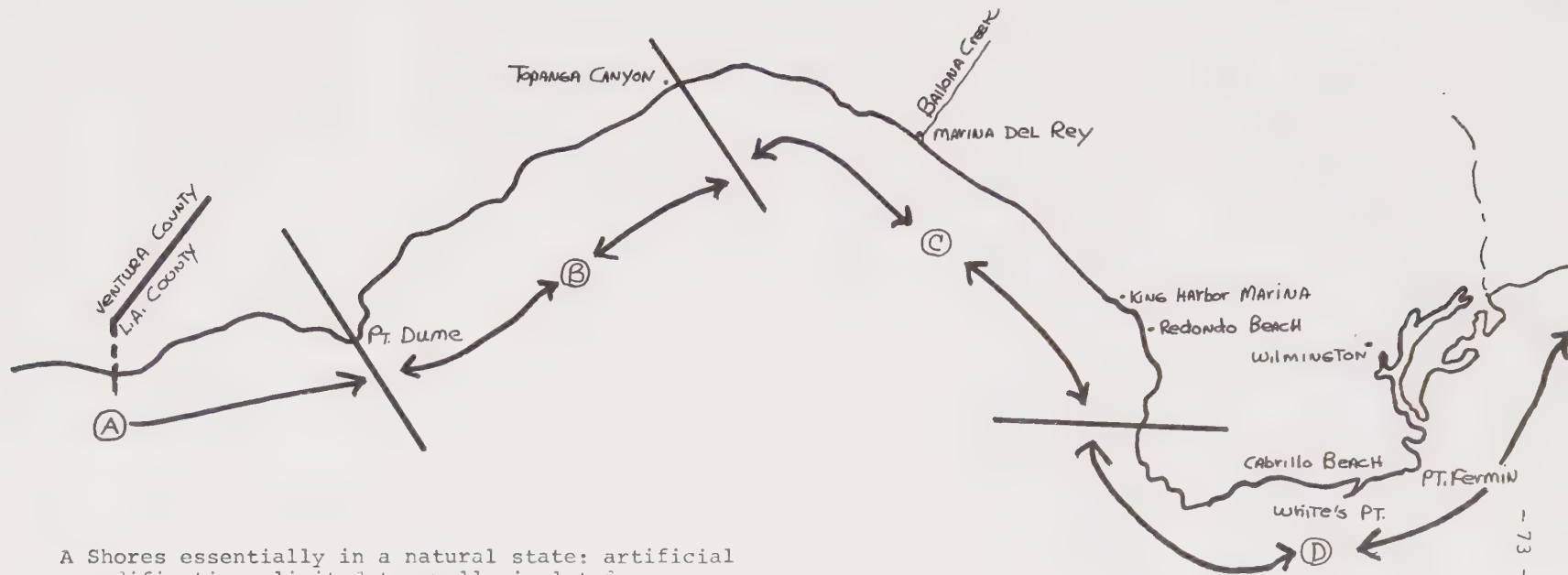
Topanga Canyon to Palos Verdes

Macrocystis cannot presently be found enduring in this area. Small plants spontaneously sprout in the Venice Breakwater but fail to survive. Because of the sandy bottom in Santa Monica Bay, kelp has nothing on which to anchor. Creating an artificially rocky bottom might aid kelp growth in the Bay.

Palos Verdes

Once kelp thrived throughout Santa Monica Bay, about Palos Verdes Peninsula, into San Pedro Bay. The last significant colonies died out about 1964. Periodically, attempts are made to culture and nurture the growth at Abalone Cove, Palos Verdes; however, the plants fail to prosper to resume their former distribution.

⁴⁸Fay, op. cit., p. 80.



- A Shores essentially in a natural state: artificial modifications limited to small, isolated areas; minor pollution; kelp generally healthy.
- B Shores with minor biological impairment: artificial modifications limited to local areas; minor to moderate pollution; no kelp below 35 feet.
- C Shores with significant biological impairment: local to dense artificial modifications; minor to locally intense pollution; no significant kelp growth.
- D Shores with major biological impairment: intense pollution; kelp destroyed.

Figure 8

Indicated Biological Health
of Los Angeles Coastline

Source: Rimmon C. Fay, An Evaluation of the Health of the Benthic Marine Biota of Ventura, Los Angeles and Orange Counties, February, 1972, Plate 3.

One of the most deleterious forces that can destroy kelp is excessive grazing by herbivores, particularly sea urchins. Urchin grazing is particularly destructive because the typical attack is made against the primary stipe, or stem. When the stipe bundle is severed, the remainder of the plant is lost to the kelp community.

Significant grazing has been observed to arise from two causes:⁴⁹

Unfavorable environmental conditions may exist due to storms, reduced subsurface illumination because of decreased day length in winter, turbidity caused by plankton blooms, or warm water conditions (over 64°F.) in summer that cause deterioration of the kelp canopy.

- . The warm water season may increase demand by grazers because feeding rates may rise more rapidly than plant growth rates.

Commercial Fishing Activity

The Department of Fish and Game has been keeping records of fish catches on an annual basis since 1916. The records indicate that relatively good statewide harvesting of fishes, principally sardines, continued until 1950. A steady decline in harvest has followed since 1950. The annual catches in the Harbor area amounted to 136,245, 199,047 and 248,241 tons in 1968, 1969, and 1970, respectively. In 1970 about 34% of this catch was accounted for by anchovies, which is quantitatively the most significant species of fish now present in Southern California waters. The dollar values of these total catches were \$30,093,746, \$38,662,824, and \$51,426,076, respectively.⁵⁰

Many of the species formerly of importance in the commercial catch are no longer sufficiently abundant to support a commercial fishery. Overfishing, or taking of illegally-sized fish, in fact, is probably the greater cause of the decline of food fish and shellfish from California waters generally. Such happened to the sardine; now it is essentially a protected species. In a similar manner, the

⁴⁹Leighton, D.L., et al, "Ecological Relationships Between Giant Kelp and Sea Urchins in Southern California", p. 143.

⁵⁰State of California, The Resources Agency, Department of Fish and Game, California Marine Fish Landings for 1968, 1969, and 1970, Fish Bulletins 149, 153, 154, pp. 39, 41, and 43 respectively.

commercial fisheries for white sea bass, halibut, barracuda, and lobster are in a marginal status off the Southern California coastline. The wetfish fleet of San Pedro also fish for bonito and bluefin tuna when they are available locally. This additional income tends to offset some fixed costs as well as increase the fisherman's annual income. Without this additional fishery, the wetfish fleet would be in worse condition.⁵¹

Not only is the abundance of many species of fishes reduced to a point where the continued existence of these species is a matter of serious concern, but many of the fishes are contaminated with toxins in sufficient concentration to preclude their acceptability for interstate commerce on the basis of current Federal Food and Drug Administration standards (mackerel, local rockfish, some tuna, some crabs).⁵²

Marine resources are not only important for their economic and recreational impact, they offer living laboratories for educational use and study of the intertidal areas of rocky shorelines and to the study of fundamental aspects of bio-medical research, such as the following:⁵³

<u>Organism</u>	<u>Application in Bio-Medial Research</u>
Sea Anenome	Aging process.
Sponges	Sources of antibiotics and anti-cancer agents; study of tissue organization.
Snails	Sources of new therapeutic agents; study of basic defenses against infection; study of nervous system and mechanism of function of brain.
Clams	Sources of new therapeutic agents; study of nerves.
Octopus and Squid	Basic research on the mechanism of function of the brain and nerves; research in vision.

⁵¹State of California, the Resources Agency, Department of Fish and Game, California's Living Marine Resources and Their Utilization, Herbert W. Frey, ed., 1971, p. 122.

⁵²Fay, op. cit. p. 84.

⁵³Loc. Cit., p. 86

Sea Urchins and
Starfish

Studies on the control of organization of tissue as applied to cancer research and basic knowledge of embryonic processes in animals.

Barnacles

Sources of improved glues for dental restoration; mechanism of muscle action.

Crabs

Nerve research.

One form of aquatic pollution, not widely considered, is the impact of toxins into the marine environment from the leeching of antifouling coatings from vessel hulls and marine equipment. The major input of these toxins occurs in harbors and marinas. Perhaps additional studies may be needed in the future to determine the effect these toxins may have on marine life.

Extraordinary Biological Occurrences

Spectacular changes in the abundance or the behavior of marine animals occur occasionally and are exemplified by blooms of red tide or unusually high or low water temperatures, resulting in extensive fish kills; overpopulation of a species to the point where it completely dominates its habitat; or stranding of marine mammals (whales, sea lions) on beaches or in shallow waters. These cyclical variations in normal biological processes, at present, have no scientific explanation. Therefore, a note of caution must be interjected to forestall indicting human intervention for all unexplained phenomena. In any complex ecosystem such as the ocean, provision must be made for unexpected biological events that go beyond the normal variation expected from year to year.⁵⁴ Some of these events fail to fit any kind of rhythmical pattern. What is needed is a more thorough knowledge and understanding of the ocean.

Conclusion

The fate of the marine biological resources of the inshore area clearly hinges upon decisions in land use and resource planning. A portion of the necessary change in direction is now proposed in the "State Policy for Water Quality Control", January 14, 1972. This policy calls for the abatement of all discharges of sewage sludge to the ocean, the source control of toxins to be eliminated from these water borne wastes, and the designation of areas of special biological significance along the shoreline where no waste discharges are to be permitted.

⁵⁴Loc. cit., p. 92.

Serious policy decisions will have to be faced in the future and tradeoffs decided, as to whether it is better to continue ocean disposal where it might have beneficial effects by "fertilizing" the ocean, or to fill land canyons and artificially create recreation areas by destroying natural biota and displacing land wildlife.

Natural water flows from the land have always had a "polluting" effect upon the marine environment. Organic matter has been sloughed to oceans for countless millenia. This is a natural process and no one ever considered it to have a long run adversity on sea life. Sediments flowed to the ocean and were deposited to form beaches.

Now, consideration of the environmental impact of additional shoreline and upstream engineering projects must be given serious and detailed attention. Environmental Impact Reports on proposed flood control measures should include an evaluation of the quantity of sediments which may be expected to be trapped upstream from the beaches.

Additionally, Environmental Impact Reports should include ideas on restoring those aspects of the environment that may be affected adversely by any project. With respect to fisheries, this might include considerations involving the provision of compatible habitats for species whose original habitat has been disturbed, such as the creation of artificial reefs. Oftentimes, only a little forethought and planning may be necessary - not expenditures of a great deal of money.

CHAPTER V

HARBORS

Harbors are a benefit to the communities which they serve. They provide recreational facilities such as beaches, recreation boat landings, fishing piers, and are especially valuable to local economies. In Los Angeles, the Harbor provides recreational opportunities, shipping and visual enjoyment.

Harbors may be natural or man-made and upon development necessarily cause substantial changes in the character of the aquatic ecosystem.⁵⁵

Today, there is increasing concern that indiscriminate development of natural resources will have irreversible effects on man's environment. In this study, it is important that the kinds of changes to the environment resulting from harbor development be identified. Where possible, it is desirable to identify the consequences of these changes and, then, to decide if these consequences are justifiable. If solutions are found for mitigating the adverse impact of changes, these means should be evaluated as to their feasibility.

Harbor development usually consists of extensive dredging operations, construction of breakwaters and dikes, building of piers, creation of new lands, elimination of existing land areas and so forth. Therefore, the process of constructing a harbor seriously affects or eliminates much of the existing aquatic ecosystem as well as many of the associated life systems on the adjacent shore lines and estuaries.

Once a harbor has been constructed the character of its waters are substantially changed. Such areas are no longer as susceptible to the flushing action of waves. Industry located near the harbor and ships may dump substantial amounts of wastes into the harbor. Because of the water flushing problem, these wastes tend to accumulate both in the local waters and as sediment on the harbor floor. The types of life which tend to settle in the harbor in the face of these changes are then, considerably different than those which originally inhabited the area. Indeed, in some instances, no life at all is possible below the water's surface.

⁵⁵Ecosystem is defined as a complex of ecological community and environment forming a functioning whole in nature.

Man's knowledge of these changes is incomplete. It is probably worthwhile to present a case study as the basis for this report. On hand are several studies pertaining to the impact of development of the Los Angeles Harbor. Using these studies, especially since they apply to this Plan, an understanding of the problems can be gained.

Planned Port Development

The City's Harbor Department presently has plans for a 1255- acre expansion of its facilities in a three-phase development program. A portion of the Harbor is to be deepened and the fill used to create new lands for shipping terminals. Channels are to be deepened and turning basins widened and deepened. This development will have a significant effect on the flow of water within the Harbor, as well as the following:⁵⁶

1. wide range of socio-economic impacts resulting from expected increases in trade and accompanying primary and secondary effects on employment;
2. reduction in the number of commercial vessels using the Harbor due to the expected use of larger ships and a corollary reduction in the discharge of pollutants in the harbor waters;
3. increased availability in the Harbor of docking and loading facilities, which should alleviate some of the pressure for cargo facilities elsewhere along the California coastline;
4. destruction of parts of the Harbor bottom habitat by dredging and land fill,
5. loss of open Harbor waters to the proposed land fills;
6. loss of marine habitats;
7. dispersion of pollutants from the sediments dredged;
8. reduction in the rates of tidal flushing in certain parts of the outer Harbor, and

⁵⁶U.S. Army Engineer District LA, Calif. Preliminary Draft, Environmental Statement, LA-Long Beach Harbors, November, 1972.

9. pollution of ground waters.

The Environmental Protection Agency (EPA), in its comments pertaining to further Harbor development, was concerned with:

1. flushing and circulation and the disruption of marine life, especially;
2. the displacement of live bait fisheries (anchovies) from the harbor; and
3. the calling for levels of growth substantially above those outlined in the California Air Implementation Plan and the population estimates of the California Department of Finance.

Apparently, the most telling criticism of the project from a conservation standpoint is the possible elimination of the anchovy population in the Harbor. Anchovies caught in the Harbor constitute from 50% to 95% of the live bait caught in California for commercial and sport fishing. The impact here is not that a unique species of fish is to be eliminated, but that an essential ingredient to the area's fishing industry is to be detrimentally affected. Whether anchovies can be caught as effectively elsewhere is not known. However, one thing can be certain: the cost of live bait will rise as a result of this action. Since the State's fishing industry is in deep financial trouble, this added cost might be extremely serious.

Another adverse effect by development of the Harbor is the effect on fish (other than anchovies) within the Harbor. As a result of water pollution, eight types of morphological⁵⁷ deviations in marine fish species can be listed:

- a. papilloma-a benign tumor with cauliflower-like appearance;
- b. exophthomia-bulging or protuding eyeballs;
- c. parasitic infestations;
- d. external deformities;
- e. skeletal deformities;

⁵⁷Morphological refers to the form and structure of animals and plants.

- f. fin or tail erosion (fin rot);
- g. lesions-deterioration of the skin; and
- h. abnormal coloration.

It is argued that increased regulations of wastes deposited in the Harbor will result in a less polluted environment for fish. Unfortunately, additional development of the Harbor will further reduce flushing. The design of these Harbor facilities should be of such a nature that the maximum "flushing" occurs. This will enable marine life to remain in waters where otherwise they might die because of low oxygen content in the water.

Water Quality Standards For The Harbor

The State establishes and enforces standards for water quality in harbors through the California Regional Water Quality Control Board, Los Angeles Region. Failure to meet these standards can result in court actions against municipalities. Therefore, the City has little choice but to conform to the standards set forth in "Water Quality Objectives and Interim Plan Water Quality Objectives" for the Los Angeles Harbor. These are as follows:

Constituent or Factor

Objectives

Bacteria (Inner Harbor)

The maximum number of E. coli organisms shall be less than 7 per cc. Not more than 5% of the samples shall exceed 7 E. coli per cc.

Dissolved Oxygen
(Harbors, Marinas
Tidal Prisms)

Inner Harbor North of Vincent Thomas and Gerald Desmond Bridges except in deadend slips and channels. The maintenance of 3 ppm of DO as it may be a result of waste discharge.

Vincent Thomas and Gerald Desmond Bridges except in deadend slips and channels. The DO shall at all times be at least 0.5 mg.

Dominguez Channel Tidal Prism -
The minimum level of DO shall be 20 mg.

Constituent or
Factor

Objectives

Temperature

Enclosed Bays - Existing elevated temperature waste discharges shall assure protection of beneficial uses.

New elevated temperatures waste discharges shall assure protection of beneficial uses and the maximum temperature shall not exceed the natural temperature of the receiving waters by more than 20 degrees F. Thermal waste discharges having a maximum temperature greater than 4 degrees F above the natural temperature of the receiving water are prohibited.

Toxicity

No toxic substance which will be deleterious to humans or aquatic biota or which would render aquatic life undesirable for human consumption shall be discharged to the receiving waters.

Turbidity

No significant increase beyond natural background levels.

Other Materials

General - There shall be no substances present, other than of natural origin, in concentrations sufficient to deteriorate flood control or marina structures or that would cause aquatic life to become undesirable or unacceptable for human consumption. Phenols, creosols, or any other substance shall not be present in concentration sufficient to impart objectionable taste to aquatic life usable for human consumption.

The Ph shall not be depressed below 7.0 units or raised above 8.5 units as a result of waste discharges.

Additional Developmental Considerations

Extensive dredging operations will most likely create pollution of marine waters. The temporary destruction of marine bottom habitats in dredged areas and permanent destruction in fill areas is unavoidable. However, every effort to minimize the effect of these operations on areas outside dredge and fill places is essential.

Extensive studies into methods by which this objective can be accomplished are needed. Examination of alternative dredging methods to date have yielded no solutions to this problem. Before extensive operations are allowed in the Harbor, an adequate solution should be identified and provision made for its implementation.

An additional problem caused by past Harbor developments is that some ground water aquifers have been intruded with sea water. Adverse head conditions⁵⁸ resulting from the proposed development may increase the potential amount of salt water intrusion. However, the Dominguez Barrier Project is operating to prevent any further contamination from salt water intrusion.

Development of Port facilities should not neglect the provision of recreational opportunities consistent with the Harbor's primary function as a commercial and industrial facility. Because of its location to large masses of low-income individuals and families, the Harbor is especially important as a recreation resource. Such recreational opportunities include bathing beaches, boating, water skiing and sport fishing. The Harbor is well served by freeways and roads, making it a generally accessible facility. Therefore, the following considerations should be a part of any Harbor plan:

- . Recreational facilities should be located and designed so that they are accessible to large numbers of people.

⁵⁸Aquifers along the shoreline which, because of Harbor development, are subject to salt water intrusion are now being contaminated. A series of water insertion wells placed between most of the fresh ground water supplies and these contaminated aquifers create a barrier to further intrusion. Several projects such as the Dominguez Barrier Project function in this manner.

- . Harbor development for purposes other than recreational use should be located in areas away from intensive recreation activities.
- . The elimination of recreation opportunities as a result of harbor development should be avoided.

Summary and Conclusion

The Los Angeles Harbor is recognized as an important City economic resource and its continued development consistent with the maximum feasible conservation of marine life is encouraged. In light of the extreme importance and multi-faceted impacts of each increment of Harbor development, an Environmental Impact Report on the entire development should be prepared. Mitigating measures for negative impacts should be proposed for each developmental phase. The EIR should also identify positive economic benefits to be derived from Harbor expansion.

CHAPTER VI

WILDLIFE AND BOTANIC COMMUNITIES

Introduction

Problems concerning wildlife and the preservation of the natural habitat are intimately connected with the maintenance of open space. Urbanization of the hillsides has led to alteration of the natural environment, causing a loss of food sources and habitat. As a consequence, animals that were not able to adjust to man's presence were pushed further and further into the mountains.

Few natural areas within the City are currently protected from development and change. Loss of natural vegetation through fire and development creates a loss of watershed and resultant flood and erosion problems. Loss of the natural flora also reduces the scenic values of an area and results in a diminished habitat for animal wildlife.

Climatically, all but a trace amount of precipitation occurs in the period from November through April. During the balance of the year, the City endures drought and faces extreme fire hazards from the highly inflammable conditions existing in the surrounding mountains. The relationship between our native plants and fires is manifested by so many special modifications in the plants that it is clear fires have always been a feature of the "brushy" communities.⁵⁹

WILDLIFE

Endangered and Rare Species

The law of the land is that wildlife is the property of all the people.⁶⁰ The U. S. Fish and Wildlife Service, the National Marine Fisheries Service and the California Department of Fish and Game all share the responsibility for protection of wildlife.

A close examination of the listing of endangered or rare

⁵⁹Raven, Peter H., Native Shrubs of Southern California, 1966, p. 14

⁶⁰Leach, Howard, "Who declares Wildlife Endangered or Rare", Outdoor California, January 1972, p. 24

native wildlife indicates that the majority of the animals are restricted in number because of a reduction in their once extensive habitat.

In 1970, the California Legislature passed the California Species Preservation Act and the Endangered Species Act. The first Act directed the Department of Fish and Game to inventory threatened fish and wildlife, to develop criteria for classifying rare and endangered species and to report to the Governor and the Legislature every two years on the status of these animals.⁶¹ The Act also established categories of fully protected fish, reptiles and amphibians and allows the Legislature to add to or delete animals from the fully protected status.

The Endangered Species Act gives authority to the Fish and Game Commission to declare animals as either rare or endangered. The Act also prohibits the importation, taking, possession and sale of rare and endangered wildlife. Factors used by the Department in determining whether an animal is endangered or rare are these:⁶²

Endangered

An endangered animal is a species or subspecies of birds, mammals, fish, amphibia, or reptiles whose prospects for survival and reproduction are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition or disease. The criteria include:

Reproduction - evidence is available that mortality is consistently greater than recruitment.

Natural Causes - Evidence is available that because of overspecialization, the species or subspecies is incapable of adapting to environmental change.

Habitat Disturbance and Destruction - Habitat essential for the survival of the species is threatened with disturbance or destruction and the animal is in immediate jeopardy.

⁶¹ Ibid.

⁶² Ibid. p. 25

Hunting and Fishing - Evidence is available that population removal by hunting, fishing and harassment by people is threatening the species with extinction.

Introduced Animals - Evidence is available that introduced species, either through predation, competition, or introduction of disease, are threatening survival of the species.

Pollution - Evidence is available that environmental pollution is threatening the survival of the species. (A case in point is the Brown Pelican, whose eggs are so fragile because of pesticide contamination that they do not hatch.)

Rare

A rare animal is a species or subspecies of birds, mammals, fish, amphibia or reptiles that, although not presently threatened with extinction, is in such small numbers throughout its range that it may be endangered if its environment worsens. The criteria include:

Numbers - Evidence is available that a species or subspecies exists in small numbers because of specialized habitat requirements and limited habitat, and that these numbers are declining.

Habitat Requirements - Evidence is available that the habitat requirements of these animals are threatened and the animal is incapable of adapting to other habitats or environmental conditions.

Distribution - Although occurring in California at the edge of its natural range, the species or subspecies exists nowhere else in the world in substantial numbers.

Endemic Animals - The species or subspecies in California is native to a particular locality of specialized habitat, and there is little hope of successful introduction elsewhere. If this habitat worsens, the animal can become endangered.

Management - Current management practices are not adequate in preventing the decline of the species or subspecies and there is immediate need of corrective measures to assure its continual perpetuation.

Table 4, page 88, indicates the relationships that exist among various types of land use activities and their impact upon significant species of wildlife. The matrix (Table 4) is not intended to be exhaustive in terms of a wildlife listing, but it can be assumed that smaller species (mammals, amphibians, reptiles, insects, birds) will be affected similarly.

Animals such as raccoons, skunks, squirrels, opossums, coyotes and deer have adapted themselves to the urbanized sector of their previously pristine environment and still roam the hills. Some hillside residents look with favor on the comings and goings of these creatures and enjoy their antics; some do not. An individual's reaction toward animals is based largely on subjective values and philosophies.

The recognized problems in maintaining wild animals in proximity to humans are nuisance, disease and safety. Raccoons and skunks are capable of carrying rabies, which can be transmitted to pets and humans via animal bites. Fortunately, the wild animal population in Los Angeles has been relatively free from rabies for the past several years.

If problems occur, it is a function of the City's Animal Regulation Department to capture the offending animal and dispose of it in some manner. It is the Department's overriding philosophy to conserve the animal when ever possible. For this reason, if it becomes necessary to remove a healthy animal from his present habitat, arrangements have been made with the United State Forest Service to relocate the animal in forested areas. Once or twice weekly, all animals that have been captured are air-lifted to compatible habitats in the Angeles National Forest.

Deer pose a special problem for the City in that they are considered to be wards of the State, and thus, come under the purview of the California Department of Fish and Game. However, under certain circumstances the Department of Animal Regulation may act on citizen complaints to relocate these animals for humane purposes.

In those areas where the deer population increases beyond the capacity of natural food sources or are forced to relocate because of development of their habitat areas, a more extensive program than that currently provided will be required.

TABLE 4

GENERAL EFFECT OF HUMAN ACTIVITY ON NATURAL HABITAT¹

	LARGE MAMMALS				WATER-FOWL		SMALL MAMMALS						OTHER
	Mule Deer	Coyote	Bobcat	Cougar	Duck	Shore-Bird	Rabbit	Squirrel	Opossum	Skunk	Fox	Raccoon	Redtailed Hawk
SETTLEMENT													
Sparse (20 ac +/Dwelling)	O	O	O	X	--	--	O	O	O	O	O	O	O
Rural (2½ to 20 ac/Dwelling)	O	O	O	X	--	--	O	O	O	O	O	O	O
Suburban (1 to 2½ ac/Dwelling)	O	O	X	X	X	X	X	O	X	X	X	X	O
General Urban	X	X	X	X	X	X	X	O	X	X	X	X	X
Industrial	X	X	X	X	X	X	X	X	X	X	X	X	X
RECREATION													
Regional Parks	O	O	X	X	O	O	O	+	O	O	O	O	O
Camp Grounds	O	O	X	X	O	X	--	+	O	O	O	O	O
Off-Road Vehicles	X	X	X	X	X	X	X	X	X	X	X	X	X
WATER USE													
Ground Water Recharge	NA	O	X	NA	+	+	+	NA	NA	X	X	X	O
Wetland ²	NA	+	X	NA	+	+	+	NA	X	X	O	O	O
Water Storage ³	O	O	O	O	+	+	O	O	O	O	O	O	O
OTHER													
Highways	--	X	X	X	O	O	X	X	X	X	X	X	X
Petroleum Extraction	X	O	X	X	X	X	O	NA	X	X	X	X	X
Sand and Gravel Extraction	X	X	X	X	NA	NA	X	X	X	X	X	X	X
Motor Boating	NA	NA	NA	NA	X	X	NA	NA	NA	NA	NA	NA	NA

- ¹ Effects are as follows:
 X intolerable by species
 -- Detrimental to species
 O May be tolerated by species
 + Contributes to species
 NA Not Applicable

² Wetland includes duck ponds, game refuge, and other rural areas where water is normally found year round. Farm reservoirs are not considered wetland.

³ Water storage includes bodies of water having little or no other use surrounding, such as reservoirs.

Within the City of Los Angeles, there are several major publicly-owned areas where various types of wildlife abound and in which any type of City action could conceivably affect the wildlife population in an adverse manner by further diminishing habitat sources.

Griffith Park

This is one of the most unique regional park facilities in the United States, inasmuch as it is a 4,063-acre natural area in the midst of a large city. Among the species of large mammals that live within the park are the muledeer, coyote, cottontail rabbit, wood rat, grey fox, bat, gopher, opossum, raccoon, skunk, and ground squirrel. Reptiles include the fence lizard, sideblotched lizard, gopher and king snakes, rattlesnake, and striped racer. Among the amphibians are the bullfrog, Pacific treefrog, California toad, and salamander. Over 30 species of birds can be found in the park and it remains a prime feeding area of the red-tailed hawk.

Due to its geologic formation, the park is riddled with caves, both exposed and buried. One of these is a rock cave, Bee Rock, that has been adopted by millions of bees for their home. This, in itself, is quite rare because there are few places within the City where bees can live in a wild state.

Two critical problems impinge upon the serenity of animals and their ability to survive in the park: cars and the expansion of public facilities. More animals are killed by cars in the park than by any other means. Many drivers use the park as a free-way by-pass and do not always adhere to the posted 25 MPH speed limit. More stringent traffic enforcement is needed. In addition, there is a noticeable lack of signs warning drivers of wildlife crossings. These crossings can be easily identified by park rangers and adequate funding should be made available for the posting of such warnings.

Every expansion of public facilities cuts into the feeding areas of wildlife. Inasmuch as the park does contain such life, a balance must be maintained between the amount of land utilized for citizen recreation and that in which wildlife is

permitted to roam. That balance has just about been reached. Therefore, further expansion for purposes such as new roads, widening of existing roads, parking lots, sanitary landfill, or golf courses should be discouraged.

Hansen Dam Recreation Area

The 1,437-acre flood control basin is leased by the City from the U. S. Army Corps of Engineers on a long-term basis for recreational purposes. In geologic terms, the area can be described as an alluvial fan, or a deposit from a stream where it issues from a gorge or canyon upon a plain.

In addition to much of the same wildlife that exists in Griffith Park, the Hansen Dam-Big Tujunga area is ecologically unique in terms of plant life. A 3/4 mile nature trail can be walked, as indicated in Figure 9. Along the trail are such diverse plants as scale broom, yucca, prickly pear and cholla cactus, black sage, mule fat, tree tobacco, willow, castor bean, manzanita, cottonwood, sycamore, buckwheat, and golden currant. In the wash stream area is located the Elfin Forest, a community of plant life composed of coastal live oak, mountain lilac, beach grass, California holly, native ferns and different varieties of sage. The Elfin Forest is very rare, being found only in Australia, Chile and the mediterranean area.⁶³

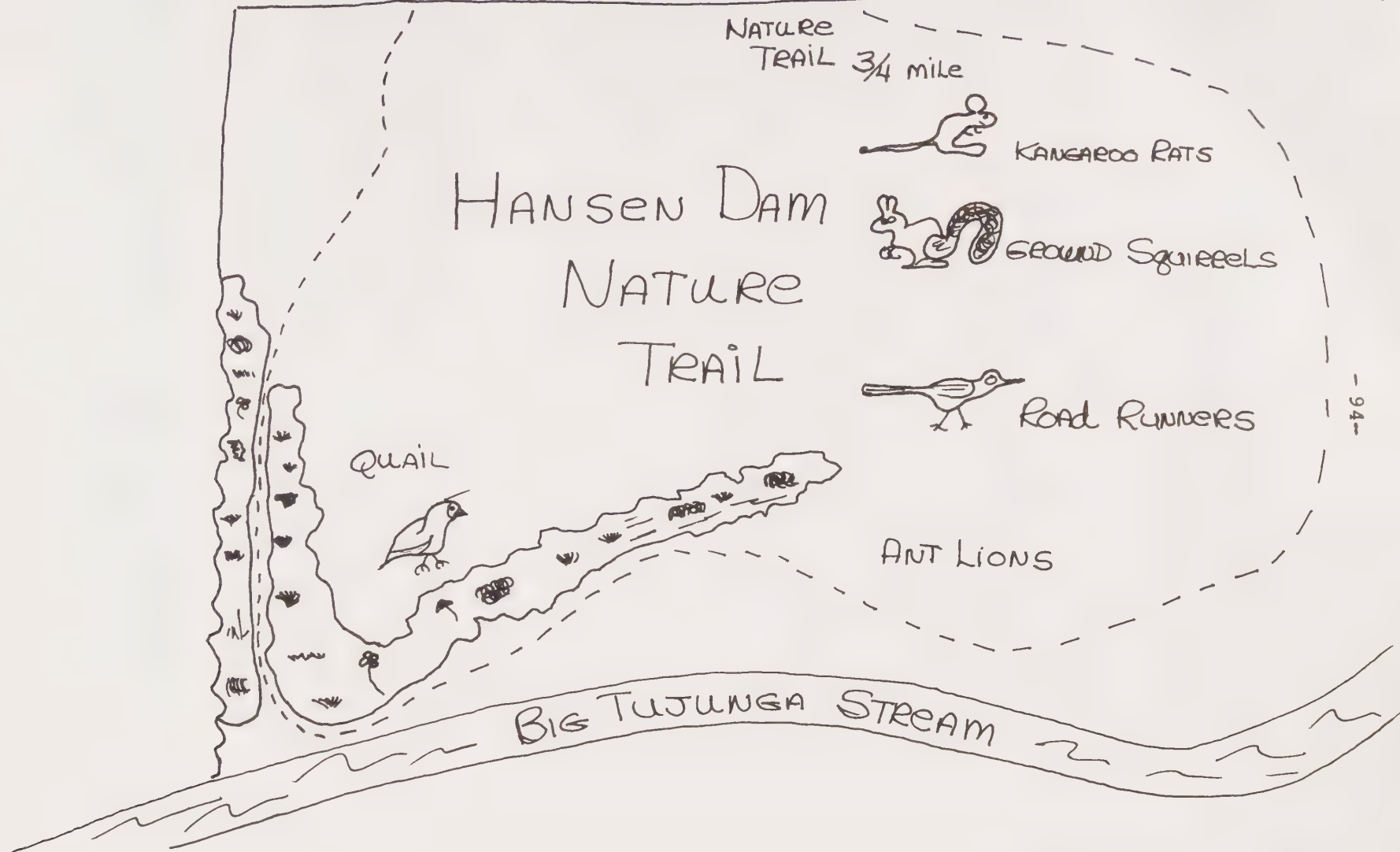
Elysian Park

Only minutes away from Civic Center, Elysian Park contains hills and valleys covered with forests of vegetation that are largely exotic in that they are not native to the area, i.e. eucalyptus, palms, Morton Bay Fig. Because there are no year-round streams, the park suffers a water shortage for most of the year. As a result, only smaller rodents and mammals are able to survive and make the park their home.

⁶³ Department of Recreation and Parks, Park Ranger Division, Hansen Dam Nature Trail Guide.

HANSEN
STABLES

Figure 9
ORCAS PARK



Harbor Regional Park

This park supplies year-round habitat for waterfowl and water-associated birds. In addition, the area provides valuable wintering grounds for other migratory birds. Because it contains shallow areas, mud flats and tules, the park can function as a valuable nesting area for wading birds.

The Port of Los Angeles has been virtually lost as a migratory or nesting refuge for water-associated birds; Harbor Regional Park, the several water reservoirs (Chatsworth, Encino), small park lakes (Echo and MacArthur Parks and Hansen Dam), the Venice Canals, and sandy beaches now comprise the only remaining habitats for these forms of wildlife. Therefore, any public action which would serve to decrease the area of the available habitat, such as freeway or landfill projects, should be discouraged in these areas and routed elsewhere. In the case of the Venice Canals, waterfowl will have to be relocated when the Canals are rebuilt and upgraded.

BOTANIC COMMUNITIES

Sufficiently diverse climatic conditions exist within the City of Los Angeles to permit a variety of habitat types to grow and develop. Each of these unique kinds of botanic communities sustains its own ecological system and some contain species protected by State law. The following has been extracted from a report compiled by the Los Angeles County Environmental Resource Committee (ERC), an evaluation team of Southern California scientists working under the combined auspices of the Southern California Academy of Sciences and the Los Angeles County Museum of Natural History. Basically, the ERC chose the listed sites with the thought of preserving or conserving the best representatives of the habitat types extant in the County. All recommendations are based on purely scientific rationales and the principal factor determining size of sites is ecological integrity and continuity, i.e., the smallest area necessary to maintain species diversity and interrelations.

A. COASTAL SAGE SCRUB

1. Definition

- a. Physical - well-drained clay or gravelly sometimes rocky or rock-strewn, slopes of coastal areas between sea and rather abruptly rising mountainous chaparral-covered slopes. Example: Coastal foothills and Griffith Park.
- b. Vegetation - half-woody shrubs, 1-5 feet tall or sometimes woodier and larger, forming a partially-open community.
2. Fragility - fire adapted. Vulnerable to heavy traffic -- pedestrian or vehicular.
3. Critical size - 100 acres will support about 15-20 pairs of gnat catchers which are endemic to this habitat of coastal sage.
4. Significant species
 - a. birds - black-tailed gnatcatcher. Status uncertain, but may be approaching population levels for placement on Rare and Endangered List.
 - b. Mammals - Western harvest mouse -- most commonly found here outside of marsh habitats.
 - c. Insects - Yucca moth required to pollinate yucca.
 - d. Reptiles - Coast horned lizard and California legless lizard are both depleted species protected by State law.

B. CHAPARRAL

1. Definition

- a. Physical - best developed of Southern California plant communities. Dense cover of shrubs up to 15 feet high on plains, mesas, and foothills; particularly well-developed on coastal side of mountains, 1,000-4,000 feet; 3,000-5,500 feet on desert side of mountains. Example: Griffith Park; Santa Monica Mountains.

- b. Vegetation - A great diversity of evergreen shrubs often with thick, leathery leaves, 3-6 or 10-15 feet high and dense, often nearly impenetrable. Many have fire-resistant seeds of long viability; many sprout quickly from rootcrowns after fires.
 - c. Characteristic plants - chamise, scrub oak, wild lilacs, quinine bush, manzanitas, and toyon.
 - d. Characteristic animals -
 - Insects - Extensive
 - Amphibians - Western Toad
 - Reptiles - Extensive, but Coast horned lizard is a depleted species protected by California law.
 - Birds - Wrentit, Mountain quail, California thrasher
 - Mammals - several species of mice, kangaroo rat, brush rabbit, California ground squirrel, chipmunk, grey fox, bobcat, coyote, weasel, skunk badger, mountain lion, ringtail raccoon, bat, deer.
2. Fragility - Fire adapted, but subject to severe fire damage due to extreme protection from natural burning. Vulnerable to damage by off-road vehicles and extreme pedestrian use.
3. Critical size - Extensive continuous tracts necessary for maintenance (several square miles at least) of large mammals such as deer and carnivores which are best maintained in this habitat.
4. Significant species
- Reptiles - Coast horned lizard
 - Birds - wrentit and California thrasher are restricted almost entirely to this habitat. Neither are currently threatened with low-population levels.
 - Mammals - Ringtail (a raccoon-like animal) most closely associated with Chaparral; protected by State law. Species is secretive but apparently characterized by low-density populations and localized occurrence.

C. RIPARIAN WOODLAND

1. Definition

- a. Physical - Numerous streams leading from mountains to coastal and desert plains and smaller streams in mountain areas. Example: Topanga Canyon, Rustic Canyon.
 - b. Vegetation - Shrubs and medium-sized trees that require a perennial water supply near or above the ground surface.
 - c. Characteristic plants - white alder, bigleaf maple, western sycamore, black cottonwood, willows.
 - d. Characteristic animals - Extensive.
2. Fragility - Subject to destruction from subdivision, channeling action, weed encroachment, and fire. Susceptible to watershed damage, water diversion, off-road vehicles, stream pollution.
3. Critical size - Canyon size, 750 acres; 1-2 miles continuous, along streams.
4. Significant species - Extensive
5. Comments - CRITICAL. Maintenance of Riparian Woodland requires the protection of neighboring habitats, ridge to ridge in the case of narrow canyons.

D. ARROYOS

1. Definition

- a. Physical - Dry sandy or rocky watercourses leading from canyons of mountains, broadening as they leave the canyons and lead to desert basins or coastal river channels. Water table usually far beneath surface; water flows in arroyos and washes after torrential or extended rains. Example: Big Tujunga Wash.
- b. Vegetation - shrubs and small trees.
- c. Characteristic plants and animals - see commentary on Hansen Dam Recreation Area

2. Fragility - Subject to destruction from sand and gravel extraction, dams (inundation) some subdivision, weed intrusion. Vehicular traffic very common and destructive.

E. FRESHWATER STREAMS AND RIVERS

1. Definition

- a. Physical - permanent or seasonal running water
Example: streams in Santa Monica Mountains.
- b. Vegetation - some submerged, but mostly emergent streamside plants. Essentially continuous with Riparian Woodland.

2. Fragility - FRAGILE. Destructively modified by channeling. Easily polluted or drained.
3. Rarity - CRITICAL. Most gone except for streams in Santa Monica Mountains.

4. Significant species

Fishes - the few native freshwater fishes just hang-on in those limited streams which have not been ruined by pollution and/or damming.

Amphibians - California newt and several species of frog.

Reptiles - Two-striped garter snake and Pacific pond turtle. Prolonged drying of the streams and rivers would mean the loss of all, including smphibians, of these species which are closely associated with the water.

5. Comments - All natural waterfalls should be included and preserved. Polluted streams may be restored if carefully controlled. See also Riparian Woodland.

F. FRESHWATER MARSHES

1. Definition

- a. Physical - This community is scattered throughout Southern California wherever shallow

standing water remains any length of time. Small areas along coast in back of brackish areas, around springs, ponds, and lakes, and along sluggish streams. Examples: Harbor Lake, Hansen Dam and Los Angeles River (natural bottom).

b. Vegetation - Emergent reeds and water weeds; floating and submerged water plants.

c. Characteristic plants - common tule, California bulrush, cattails, spike rushes.

d. Characteristic animals

Insects - great variety of aquatic or semi-aquatic insects.

Amphibians - various toads and frogs

Birds - red-winged blackbird, two species of rails, green heron

Mammals - shrews, harvest mouse, raccoon, weasel

2. Fragility - Fragile. Weeds; flood control; subject to draining and filling; easily polluted.

3. Comments - Major stopping areas for migrant waterbirds (bitterns, ducks, herons, marsh wrens, etc.). This habitat can support 5-10 pairs of birds per acre with little difficulty.

G. COASTAL STRAND AND DUNES

1. Definition

a. Physical - A narrow community of limited areas with high humidity, frequent fogs, and low summer rainfall. Example: El Segundo Dunes (Airport Dunes).

b. Vegetation - Low succulent perennial shrubs and woody perennials.

c. Characteristic plants - iceplants, lupine, shore sandbur, white-leaved saltbush.

2. Fragility - subject to loss from recreational misuse (dune buggies), subdivision. Extremely vulnerable to traffic of any kind.

3. Significant species

Reptiles - California legless lizard and coast horned lizard. Both are depleted species protected by State law and associated with the stabilized parts of this habitat community.

4. Significant species

Birds - Light footed clapper rail and California black rail are on the rare and endangered species list of the U. S. Fish and Wildlife Service. Belding's savannah sparrow is severely threatened and may be placed on official list shortly. California least tern feeds heavily on estuaries and also is on the official list.

Mammals - southern marsh shrew and several species of mice.

5. Comments - Almost gone -- URGENT

H. ROCKY COASTAL

1. Definition

- a. Physical - Surf-beaten rocky beaches, shores, and sea cliffs; a narrow strip between low tide and shoreline where sands and rocks are often wet or damp. Example: Coasts at San Pedro Hills, Los Angeles Harbor breakwater.
 - b. Vegetation - mainly attached green, brown, and red algae.
 - c. Characteristic animals - barnacles, crabs, abalones, sea urchins, rock systems, sea anemones, sea slugs, sea cucumbers.
2. Fragility - Easily destroyed by pollution, heavy foot traffic, indiscriminate collecting and human disturbance.

3. Significant species

Birds - Surfbird, wandering tatter, black oyster catcher are restricted to this habitat. The brown pelican and the California least tern, two species on the Endangered list, use this habitat for feeding.

Tables 5 and 6, following, specifically list animals and plants indigenous to habitat areas found within the City and that are rare or endangered. Environmental Impact Reports on developments being prepared in such habitat areas shall be required to deal with these species in detail.

TABLE 5

OFFICIAL LIST OF RARE AND ENDANGERED ANIMAL
SPECIES INDIGENOUS TO THE CITY OF LOS ANGELES

<u>Species</u>	<u>Habitat in City</u>
Coast horned lizard	Coastal sage scrub, chaparral, arroyos, coastal strand and dunes
California legless lizard	Coastal sage scrub, arroyos, coastal strand and dunes
Ringtail (related to the raccoon)	Chaparral
Two striped garter snake	Riparian woodland, freshwater streams
California mountain king-snake	Riparian woodland
Light-footed clapper rail	Freshwater marshes, salt marsh and estuaries
California black rail	Salt marsh and estuaries
California least tern	Salt marsh and estuaries
Salt marsh harvest mouse	Salt marsh and estuaries
Brown pelican	Rocky coastal

Source: United States Fish and Wildlife Service,
Department of the Interior
State of California, Department of Fish and
Game

TABLE 6

INVENTORY OF RARE AND ENDANGERED AND POSSIBLY
EXTINCT PLANTS INDIGENOUS TO CITY OF LOS ANGELES

<u>Species</u>	<u>Habitat in City</u>
AMARYLLIDACEAE- Amaryllis family. <u>Brodiaea filifolia</u> Watts. (<u>Brodiaea</u>)	Found locally in heavy clay soil, below 2,000 feet; coastal sage scrub, chaparral.
BERBERIDACEAE- Barberry family. <u>Berberis nevinii</u> Gray (Nevin Barberry)	Gravelly and sandy places below 2,000 feet; coastal sage scrub, chaparral -- Big Tujunga Wash; nearly extinct in San Fernando Valley and Arroyo Seco near Pasadena.
COMPOSITAE- Sunflower family. <u>Aster greatai</u> Parish. (<u>Aster</u>)	Found on moist or dry sites in canyons, 2,000 to 4,000 feet; chaparral.
<u>Chaetopappa lyonii</u> (Gray) Keck	Found in clay soil on the coastal part of Los Angeles County.
CRASSULACEAE- Stonecrop family. <u>Dudleya densiflora</u> (Rose) Moran. (<u>Live - Forever</u>)	Found on rocky cliffs, between 800 and 2,000 feet; chaparral.
<u>Dudleya multicaulis</u> (Rose) Moran. (<u>Live - Forever</u>)	Found in dry stoney places, below 2,000 to 2,500 feet; coastal sage scrub, chaparral.
CRUCIFERAE- Mustard family. <u>Cardamine gambelii</u> Wats. (<u>Bit-tercress</u>)	Found in swamps, mostly below 4,000 feet; coastal sage scrub, chaparral.
MALVACEAE- Mallow family. <u>Malacothamnus davidsonii</u> (Rob.) Greene	Found in sandy washes and flats, 1,000 to 1,200 feet; coastal sage scrub; Big Tujunga Wash.
POLYGONACEAE- Buckwheat family. <u>Chorizanthe Leptoceras</u> (Gray) Wats.	Found occasionally in sandy places; coastal sage scrub.

<u>Species</u>	<u>Habitat in City</u>
<u>Eriogonum giganteum</u> Wats. <u>ssp. formosum</u> (K. Edg.) Taven. (Wild buckwheat)	This occurs on dry slopes; chaparral.
RUDIACEAE- Madder family. <u>Galium grande</u> McCl. (Fide Dempster & Stebbins) (Cleavers)	2,000 to 4,000 feet; chaparral.

The Los Angeles County Environmental Resource Committee has identified the following examples of habitat priority categories:

1. CRITICAL: IMMEDIATE ACTION CATEGORY

<u>Site</u>	<u>Habitat Types</u>	<u>Remarks</u>	<u>Ownership/Control</u>
Airport Dunes	Coastal Strand	Only salvageable coastal dunes in County. Also known as El Segundo Dunes.	City of Los Angeles/ Department of Airports
Ballona Creek	Salt Marsh	One of two remaining salvageable salt marshes in County.	City of Los Angeles; private land

2.. VERY IMPORTANT: ACTION PLANNING CATEGORY

Chatsworth Reservoir	Fresh Water Marsh and Pond	Important aquatic and marsh bird habitat site	City of Los Angeles/ Department of Water & Power
Harbor Regional Park	Fresh Water Marsh and Pond	As above. Major significance as educational resource.	City of Los Angeles/ Department of Recreation & Parks
Rustic Canyon	Riparian Woodland Chaparral	One of several highly desirable, yet relatively undisturbed canyon sites in the Santa Monica Mountains.	Private land, various ownerships.

<u>Site</u>	<u>Habitat Types</u>	<u>Remarks</u>	<u>Ownership/Control</u>
Santa Ynez-Temescal	Riparian Woodland, Coastal Sage, Chaparral	Rugged relatively undisturbed inter-connected canyon area. Scenic upper canyon topography.	Private land, various ownerships.
Tujunga Valley (Tujunga Wash)	Arroyo, Fresh Water Marsh, Coastal Sage, Chaparral, Riparian Woodland	Extensive outwash plain some of the best fresh water marsh left in County	Private land, various ownerships
Verdugo Mountains	Riparian Woodland Coastal Sage.	Extensive relatively undisturbed habitats	Majority in private ownership

3. IMPORTANT: INFLUENCE PLANNING CATEGORY

Encino Reservoir	Chaparral	City of Los Angeles/ Department of Water & Power
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Conclusion

Most human activities are detrimental to wildlife habitats; however, some activities are tolerable and, in fact, are highly beneficial to some wildlife types., e.g., the creation of duck ponds or other water habitats for aquatic birdlife. The potential effect a land use activity has on wildlife habitat has not normally been considered in the decision-making process. An adequate land use program including decisions on specific projects or actions must involve tangible considerations of the existing natural values. The physical capabilities of an area to support a potential land use activity and the inherent economic advantages must not remain the only qualifications to suitability. Consideration must also involve all potential effects, both beneficial and detrimental, resulting from a change in the natural environment.

The City contains several areas of ecological importance some of which are under municipal control and others which are under the control of other governmental agencies or are privately-owned. For a viable wildlife community, land uses known to be detrimental to identified wildlife habitats must be guided to other areas where such use would be feasible, and not disastrous to established wildlife types.

To protect open areas against fire, smoking or burning of any kind in hazardous areas must continue to be prohibited regardless of the time of year. Also, prohibitions should be instituted against the use of motorcycles and trail bikes in mountain areas, because too often these vehicles are not equipped with spark-resisting mufflers, in addition to the destruction they cause to fragile habitats when driven cross-country.

Not only must plant life contend with natural forces for survival, but also with man. How easy it is for a bulldozer to rip out a life form that has taken 50 or 100 years to grow. Yet, this is being done all over this City -- governmental agencies are often among the most insensitive offenders.

Trees are constantly being ripped out all over Los Angeles to make room for highways. Surely there is some accommodation to be made that will satisfy those who wish to use the land for other purposes. Public officials must

learn to consider the importance and need for trees and other biota when improvement projects are being considered. By the creative application of mental energy and a few extra dollars, we could certainly come up with solutions that would be more amenable and make more sense than destruction for the sake of expediency.

CHAPTER VII
MINERAL RESOURCES
SAND AND GRAVEL

Background

Sand and gravel are the primary rock resources of the City;⁶⁵ they are used exclusively for construction. Within the City, little commercially valuable rock occurs; that which is of commercial value is used for road base or for crushing into sand and gravel. Local rock, sand and gravel is of granitic and granite origin.⁶⁶

The major sand and gravel deposits in the City are located in the northeast sector of the San Fernando Valley. These deposits are in the stream and alluvial beds of the Big Tujunga River, areas known respectively as the Tujunga Wash and the Tujunga Cone.⁶⁷ (See Figure 10 for the specific locations of the major deposits). The aggregate in the Tujunga Wash is periodically replenished. In the Tujunga Cone, however, flood control measures have interfered with the replenishment process and, with continued mining, the resources of the Cone will ultimately be depleted; much is already no longer recoverable due to development.

In 1954, it was estimated that the areas then zoned for gravel mining would be depleted by 1970 and that the recoverable deposits adjacent, if zoned for mining, would extend the City's supplies for approximately 20 years or until 1990. The estimates were based upon

⁶⁵ In addition to sand and gravel, other rock resources are also found in the City's soil. One hundred and three (103) have been identified in Los Angeles County, most of which are found in the Santa Monica and San Gabriel Mountains. In the past, a few of the deposits were mined commercially but, due to urban development, most of these minerals are now inaccessible.

⁶⁶ Harold B. Goldman, Sand and Gravel in Southern California: An Inventory of Deposits and Geology, 1968, pp. 18-19.

⁶⁷ Frank Gillelen, "Sand and Gravel Resources in the San Fernando Valley", a report to the City Council, 1954, City Plan Case No. 877; City Council File No. 25766; See also Goldman, loc. cit.

a field survey and upon assumptions as to economically and technologically minable depths, setback and slope regulations, and demand.⁶⁸

At the time of the survey, development had already occurred over otherwise recoverable deposits. Since the survey, development has continued; several pits have been reclaimed for other uses and several new mining districts approved. The data supplied by the survey has not been updated in the 16 years hence. "A review of the holdings of gravel companies indicates that their zoned reserves are depleting as anticipated, but at a faster rate, because of higher than anticipated annual demand".⁶⁹

On the supply side, the extension of the life of the City's reserves is being affected by deeper mining practices in the Tujunga deposits, the tapping of various limited reserves outside the Tujunga Cone⁷⁰ (which were not considered in the Gillelen estimates of 1954), and the tapping of reserves made recoverable by new capabilities of modern mining and grading

⁶⁸ Gillelen, op. cit.

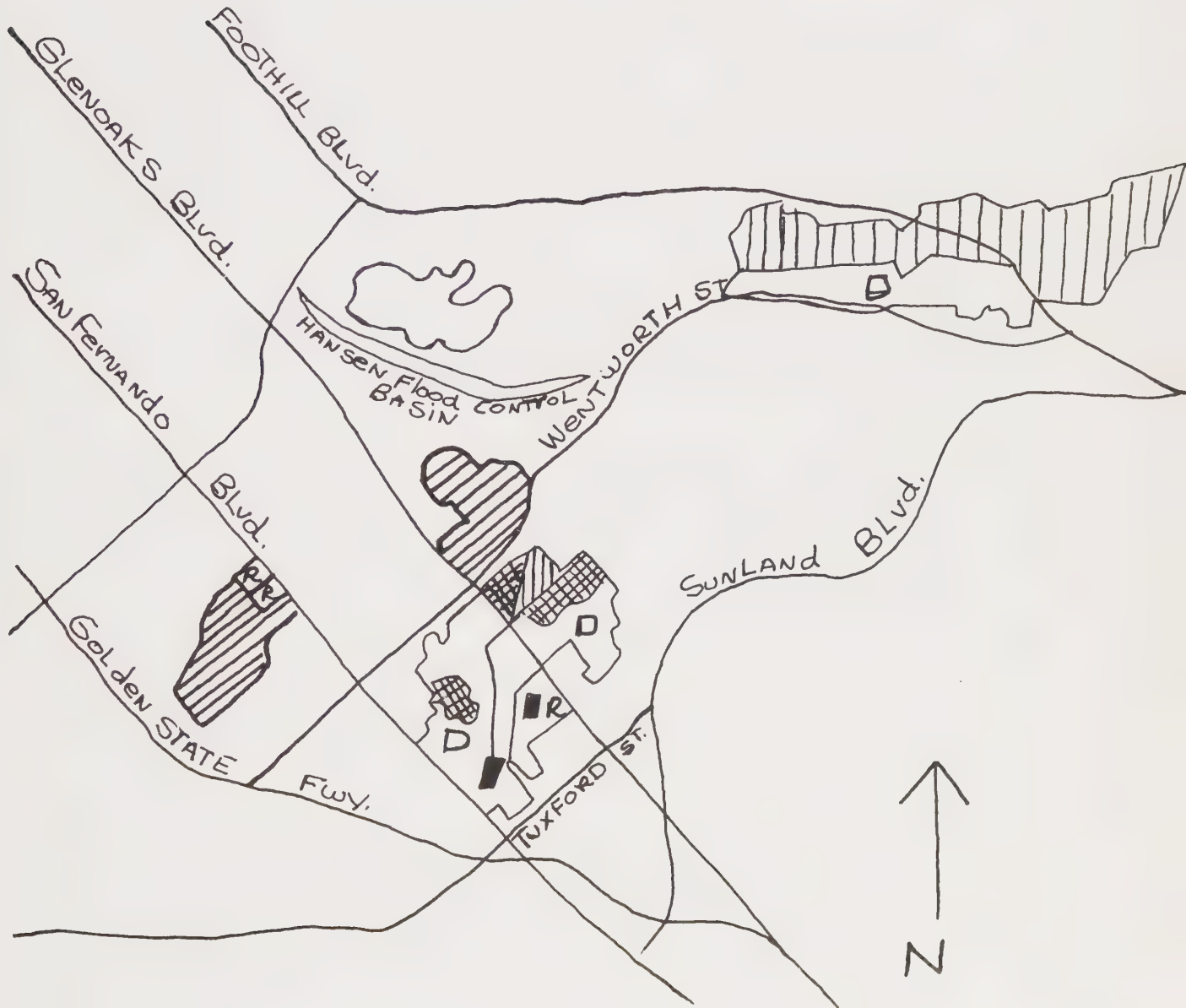
⁶⁹ Harold Goldman and Edmund Kiessling, Memorandum re "Sand and Gravel Resources in the San Fernando Valley, California", February 17, 1969.

⁷⁰ A recent mining district was established in Forest Lawn Cemetery near Griffith Park, permitting the limited recovery of decomposed granite rock and simultaneous preparation of the site for future residential, park or cemetery development. The district was approved as a mining district but with the grading regulations of the Building Department applying. The rock mined from the Forest Lawn site is reportedly valued as base for freeway construction. See City Plan Case No. 21908. November 27, 1968.

Another resource is a sand dune formation located south of the International Airport. The site is owned by the Department of Airports and is planned as a site for future expansion of airport facilities and for passive beach area. In the past, the fine sand of the dune was mined for glass production, but is no longer being utilized for that purpose.

FIGURE 10

SAND AND GRAVEL RESOURCES IN THE
SAN FERNANDO VALLEY



Remaining reserves zoned
for extraction



Reserves not zoned for
extraction



Boundaries of sand and
gravel company property



Sand and gravel plant

D

Depleted pit

R

Reclaimed pit

equipment.⁷¹ (see table 7 for a summary of mining operations in the Tujunga area).

In addition to reserves of sand and gravel on land, it is also known that the oceans contain much sand and gravel. The oceans are constantly fed deposits by streams, rivers and channels. Technologically, ocean sand can be recovered by dredging, although dredging is far more expensive than is land mining, and in the foreseeable future it will not be economically feasible to mine ocean deposits for commercial purposes.

In the City of Los Angeles, removing beach or ocean front sands for commercial recovery is illegal. Dredging in coastal waters can seriously affect the beaches and shoreline; it also has the potential of doing great ecological damage to ocean life.

The demand for sand and gravel in the City of Los Angeles has ranged between 5 and 6 million tons yearly since the 1950's, fluctuating closely with the building cycle.⁷² It is surmised that the basic demand for sand and gravel in construction will be little affected by substitute materials and will be most affected by basic population growth.

Two of the nation's twenty-five largest sand and gravel mining operations are located in the Tujunga Cone. A third company ranks among the top 100 largest companies.⁷³ In all, four mining companies operate in the Sun Valley area.

⁷¹ One of the technological developments is the portable or mobile plant. Portable plants are designed primarily to extract sand and gravel from smaller, scattered or more remote deposits, and are particularly adaptable to servicing jobs such as highway construction where the delivery site may move at frequent intervals.

Mobile plants are semi-permanent; the components are readily disassembled and mounted on skids rather than concrete footings during operation at the site.

⁷² California Division of Mines and Geology. Statistical Bulletins.

⁷³ "100 Largest Sand and Gravel Plants," Rock Products October, 1969, 39-55.

TABLE 7
INVENTORY OF SAND AND GRAVEL
DEPOSITS IN THE SAN FERNANDO VALLEY

DEPOSITS				UTILIZATION				
Name and Location	Type and Extent	General Features	Rock Types (Percent)	Name, Location of Operator	Pit Date	Processing Date	Reported Capacity	Products
Big Tujunga River Los Angeles County, near Sun Valley	Alluvial fan deposit extends from mouth of canyon so. to Sherman Way, approx. 7 miles east of Hansen Dam, deposit is restricted to the present dry wash & averages 3000' in width & 30' in depth So. of the dam the deposit widens from 1 mi. to 4 mi. The fan is bordered on the west by Tujunga Wash & on the east by Sunland Ave. which is at the base of (cont'd)	Little overburden. Upper 40 to 50' contains sand ranging from 50 to 75% Next 100' contains 55 to 60% gravel. The average maximum size of gravel diminishes from 12" upstream, to 2" near Sherman Way. Abundant boulders more than 3' in diameter occur upstream but only a few percent of gravel exceeding (cont'd)	Granite..95 Metabasic igneous.. 3 Schist... 2 (Data from USBR)	Blue Diamond Corp. 1650 S. Alameda St. Los Angeles NW 1/4 Sec. 32 (proj.) T.2 N., R.14 W., SBM. In Sun Valley	Excavate with electric shovel from pit, 1400' by 1200' to 160' depth. Convey by belt approx. 3600' to plant.	Crush oversize in primary jaw, 6 cone crushers Wash over standard vibrating screens, 5 sand screws.	450 tons per hour; 310 tons per hour washed aggregate.	Concrete and bituminous sand and gravel, road base.
				California Materials Co. 9228 Tujunga Ave. Sun Valley SW 1/4 Sec. 20 (proj.) T.2 N., R.14 W., SBM. About 1 mile north of Sun Valley.	Excavate w/electric shovel from pit 2700' by 1400' to 125' depth. Convey about 2500' to plant on belts.	Crush oversize in 42" by 48" primary cone crushers. Wash over standard vibrating screens; sand wheels.	300 tons per hour washed aggregate.	Concrete and bituminous sand and gravel road base.

TABLE 7 (Cont'd)

Name and Location	Type and Extent	General Features	Rock Types (Percent)	Name, Location of Operator	Pit Date	Processing Date	Reported Capacity	Products
	the Verdugo Mtns. Below the dam the deposit ranges up to 150' in depth; however, decomposed granitic boulders are present at that depth.	2" occur in the southern-most portion of the deposit. No replenishment. Most of the deposit is urbanized and cannot be mined.		Consolidated Rock Prod. Co. 2730 So. Alameda St. Los Angeles NE 1/4 Sec. 30 (proj.) T.2 N., R.14 W., SBM. About 1 mile north of Sun Valley.	Excavate w/9 cubic yard electric shovel from pit which will cover approx. 100 acres, to 175' depth. Convey pit-run to plant on belt, approx. 7500'.	Crush in 42" by 48" primary jaw and four secondary cone crushers. Wash over standard vibrating screens. Process sand in a sand wheel rake classifier and sand screw.	700 tons per hour washed aggregate.	Concrete and bituminous sand and gravel, road base.
				Livingston-Graham Rock and Gravel Co., Inc. 5500 N. Peck Rd. El Monte SW 1/4 Sec. 10 (proj.) T2 N.R.14W SBM. About 1 mile west of Sunland	Excavate w/shovel from two pits 1100' by 800' & 800' by 550' to 60' depth. Haul in bottom dumps & by belt conveyor approx. 1650' to plant.	Crush in 30" by 42" primary jaw and gyratory crushers, 4' short head and 4-1/2' standard cone crushers. Wash over standard vibrating screens; 3 sand drags.	180 tons per hour washed aggregate. (Idle in 1967).	Concrete and bituminous sand and gravel, road base.

TABLE 7 (Cont'd)

Name, Location of Operator	Pit Date	Processing Date	Reported Capacity	Products
Livingston- Graham Rock and Gravel Co. Inc. 5500 N. Peck Rd. El Monte NE 1/4 Sec. 30 (proj.) T.2 N.R.14W. SBM. About 1 mile northwest of Sun Valley.	Excavate w/shovel from pit 900' by 1200' to 230' depth. Haul in end dump trucks and by belt conveyor approx. 1200' to plant.	Crush over- size in pri- mary jaw, secondary jaw and 3 cone crush- ers. Wash over stan- dard vibra- ting screens; 2 sand drags.	200 tons per hour washed aggregate.	Concrete and bi- tuminous sand and gravel, road base.

SOURCE: Sand and Gravel in Southern California:
An Inventory of Deposits and Geology,
 by Harold B. Goldman (1968), p. 19.

All levels of government play a role in the regulation of sand and gravel mining.⁷⁴ The nature of the regulations ranges from land use, taxation, employee safety, ground water protection to transportation. The most controversial regulations regard the land use itself. Following is a chart indicating the functions of each regulatory agency. (See Table 8).

Resource and Environmental Conservation Issues: As with other mineral resources, there are two basic conservation concerns in the mining of sand and gravel: resource conservation and environmental conservation. Resource conservation is concerned with assuring sufficient supplies of a resource to meet current and future demands. Environmental conservation is concerned with preserving and/or protecting the environment from various forms of degradation engendered by surface mining.

The following has been offered as a four-point definition of mineral conservation which is applicable to sand and gravel mining within the City:⁷⁵

1. Total exploration, assuring that minerals will be obtained from the best locations, thus minimizing the amount of surface that must be defaced in the form of stripping... and pollution of air.
2. Mineral extraction assuring that every last bit of useful mineral is obtained before going to another location, thus again minimizing the total area defaced.
3. Efficient utilization, requiring that industrial processing be the best that modern technology makes possible, thus assuring that the minerals found and extracted are processed to win their total available yield.
4. Useful restoration; this may mean re-forestation, back-filling, leveling for housing development, park areas, and so forth.

⁷⁴ Recently there have been several suggestions recommending the entry of State and/or Federal government in the planning and/or control of surface mining. Presently the planning and control of the land use is under the jurisdiction of local government. One proposal in California was that the State Div. of Mines and Geology should pursue "studies of specific marketing areas in the State that were deemed critical in terms of depletion of sand and gravel deposits due to urbanization". See Goldman and Kiessling, op. cit., p. 1.

⁷⁵ "Ecology and Economics", Rock Products, November, 1969. 83.

TABLE 8
REGULATORY AGENCIES OF THE SAND AND GRAVEL INDUSTRY IN
THE CITY OF LOS ANGELES BY GOVERNMENTAL JURISDICTION

<u>Regulatory Agency</u>	<u>Functions</u>
CITY OF LOS ANGELES	
Department of Building & Safety	Enforces the Zoning Code.
Department of City Planning	Prepares land use plans. Administers the Zoning Code.
Department of Public Works	
Bureau of Standards	Provides support services in measurement and analysis of dust, vibrations, soils, etc.
Department of Water and Power	Acts to protect the ground water system from pollution.
COUNTY OF LOS ANGELES	
Air Pollution Control District	Administers and enforces the State Air Quality Standards. Monitors dust and request the installation of dust control systems.
Health Department	
Bureau of Occupational Health	Protects employee health from occupational hazards.
Tax Assessor, Appraisal Unit	Land appraisal Estimates resource reserves.
STATE OF CALIFORNIA	
Division of Industrial Safety	Enforces the State "Quarry and Open Pit Safety Orders".
Division of Mines and Geology	Compiles statistics on the industry.

TABLE 8
(Cont'd)

<u>Regulatory Agency</u>	<u>Functions</u>
Regional Water Quality Control Board	Enforces the Porter-Cologne Water Quality Act of 1969. Protects waters of the State from pollution.
Public Utilities Commission	Establishes zones and rates for the transportation of sand and gravel. Also requires dust control of goods in transport.
U.S. GOVERNMENT	
Internal Revenue Services	Administers the "depletion allowance" for the natural resource industries including sand and gravel mining.

The following factors are involved in determining the supplies of sand and gravel, and the measures necessary to insure their conservation:

(1) Physical and Economic Recoverability: A resource generally is not physically or economically recoverable when urban development covers it. Further, sand and gravel may not be economically recoverable if it lies beyond a given depth, or is covered by a great "overburden" (i.e., other types of soil), or when it occurs in quantities or concentrations too small to justify mining. Many of the sand and gravel deposits in the City are not recoverable due to urbanization.

(2) Location of Deposits in Relation to the Market:

Sand and gravel is in abundant supply throughout the nation; but, because of the factor of transportation, the supplies which are most valuable are those which are located within metropolitan areas, where the demand is high. Sand and gravel are high-bulk, low-value products, a fact which makes it difficult to accept or justify mining at more distant sites when there is an option to obtain the product closer to home.

Though abundant, deposits are not ubiquitous. Within a 50-75 mile radius of the City of Los Angeles, large deposits are known only in the San Gabriel Valley, San Fernando Valley, Kern County and Ventura County. Mineral extraction, therefore, has very limited locational alternatives. If it is the objective of local government to be self-sufficient in basic construction materials, deposits must be considered givens and other uses planned around the deposits.

Current Environmental Problems in Sand and Gravel Mining

The major environmental problems encountered by the City in sand and gravel mining are reclamation, rehabilitation, dust control, noise and vibration control, and esthetic considerations. Efforts to achieve an effective reduction of these environmental

problems is impaired by a provision in the Zoning Code which restrains the City from applying modern regulations to any of the mining operations established before the adoption of the Comprehensive Zoning Code in 1946.

Reclamation and Rehabilitation: "Reclamation" of a mining pit refers to the restoration of land for useful purposes.⁷⁶ "Rehabilitation", often used interchangeably with reclamation, refers to the actual or planned reuse of the land.

Several pits have been reclaimed within the City, though there are not regulations requiring reclamation. The industry's motive in reclamation is primarily economic; and government's motive stems from a "sense of stewardship". These motivations are explained by a spokesman of the industry:

Sense of stewardship or public duty:
this is the feeling that the good earth...
should not have portions of it desecrated
as a result of our short presence here.
This is the feeling that our neighbor's
enjoyment of his property should not be
unreasonably affected by what we do to
ours. This is the feeling that owner-
ship of land is not quite absolute, but
carries with it certain obligations
regarding how it may be used or left.

Economics: where this factor is present,
it is no more necessary to have legislation
requiring reclamation than it was necessary
to have legislation requiring that the
excavation be made in the first place.⁷⁷

Reclamation in the City of Los Angeles has been accomplished through use of the pits as sanitary

⁷⁶ W. I. Thieme, "The Present Status of Reclamation in the Sand and Gravel Industry", Pit and Quarry, April, 1969, p. 154.

⁷⁷ Ibid. , pp. 154-8. Other motivations identified are the requirements imposed by zoning and other legislation.

land fills.⁷⁸ No pits have been reclaimed by any other method.

Presently there is an impasse in the continuing reclamation potential of the pits. Because of new knowledge of the effects of sanitary land fills on ground water,⁷⁹ reclamation as previously practiced is being disallowed. Research and development on linings which are impervious to the passage of contaminants is being conducted by industry but, to date, no satisfactory liner has been submitted to the California Regional Water Quality Control Board, Los Angeles Region, the administrative agency charged with the protection of the ground waters of the State.

The Regional Board allows the use of unlined pits as dump sites for nonwater soluble, nondecomposable inert solids, such as earth, rock, gravel, concrete, glass, asphalt paving fragments, plaster and plaster board, manufactured rubber products, steel mill slag, clay and clay products, and asbestos shingles. Presently, sufficient quantities of the above materials are not generated to fill the pits at a satisfactory rate.⁸⁰ This is partially because the City rubbish collection system doesn't separate the different classes of rubbish.

⁷⁸ Among those reclaimed sites are the site of the Valley Steam Plant in Sun Valley; a site at Victory and Vineland (Tujunga Cone) and a site outside the Tujunga Cone, in West Valley, bounded by the Los Angeles River, Tampa, Kittridge, and Van Alden. Hewitt Dump in Sun Valley is a former pit which is being reclaimed through use as a sanitary land fill.

⁷⁹ See Section VI of the Environmental Conservation Element Working Paper on Solid Waste Disposal. Also, Los Angeles City Department of Public Works, Bureau of Sanitation, Minimum Requirements for Dumps in the City of Los Angeles, as amended Aug. 29, 1969; and Los Angeles Regional Water Quality Control Board, "Adopting Objectives for Prevention and Control of Water Pollution" with respect to disposal of wastes on land in the South Coastal Basin within the Los Angeles Region, Resolution No. 55-1. 1955.

⁸⁰ Personal communication with Mr. Lawrence Meyerson, Senior Water Quality Control Engineer, California Regional Water Quality Control Board, Los Angeles Region, June 18, 1970. See also Los Angeles Regional Water Quality Control Board, op. cit.

The use of water for reclamation may have possibilities in some areas and some pits, but solid fill would still be required since there is not the justification for a lake as deep as the pits are mined today. The resource may be mined to the depth of the water table, a depth which varies from approximately 150 to 250 feet. The use of the pits as water bodies also requires protective measures against ground water contamination.⁸¹ Another possibility is to accept some depression in the finished elevation of the reclaimed site and somehow manage the drainage and safety problems which would be incurred.

The present Zoning Code does not lay the groundwork for pit reclamation; the initiative for reclamation is left entirely with the private sector. After depletion or abandonment of a pit, the Zoning Code requires only a general cleanup of the site (Section 13.03C, 1, e).

Modern land use practices today are requiring plans for reclamation as a condition to mining approval,⁸² phasing schedules, and bonding to assure reclamation.

Reclaimed land has certain limitation for reuse. There is always some settling, and the Building Code requires that foundations be established below the natural ground. In the Tujunga Cone this would be

⁸¹ On the outskirts of a nearby city in Orange County, Anaheim, a former sand and gravel pit was recently rehabilitated into a trout lake. The lake is used to filter water into an underground basin. See article by Lupi Saldana, "Sand Pit Blossoms into a Trout Lake" in the Los Angeles Times, May 15, 1970, Part III, p. 13.

⁸² There are limitations as to the specificity of reclamation planning. For instance, several factors are unpredictable, such as economic variables: new competing products and changes in the specifications for products; changes in the technology of mining; and alterations in legislative requirements such as zoning, air and water pollution control laws, and mine safety regulations and labor laws. See Marion B. Walls, Mining Engineer, statement before the California Study Committee on Surface Mining, Los Angeles, May 21, 1969.

some 200 feet below the street elevation. Structural development, however, is not necessarily ruled out. Depending upon the span on the pit, it might be possible to bridge the structure across the width of the pit; or, with prior planning, it may be possible to leave strategic high points in the mining area for future foundation supports.⁸³

Among the uses suggested for reclaimed pits are parks, golf courses, wildlife areas, water sport areas, excavations for constant temperature laboratories and for document storage, waterfront homes, target ranges and amphitheatres.

Dust Control: The harmfulness of dust⁸⁴ produced in local sand and gravel operations on the health of normal individuals has not been conclusively determined. Regulations, therefore, are addressed primarily to controlling the nuisance aspects of the activity.

Several governmental agencies are concerned with dust control: the County Air Pollution Control District (APCD); the County Health Department; the City Planning Department, and the State Public Utilities Commission.

The primary regulatory agency is the APCD, which is concerned with the control of air quality of the outdoor environment.

⁸³ Suggestion of Mr. Michael Salzman, former Principal City Planner, Los Angeles City Planning Department.

⁸⁴ Harmfulness of dust is measured and evaluated by (1) silica (or toxic) content; (2) particle size; (3) concentration of particles; and (4) length of exposure. Particles or concentrations of particles are classed as either nuisance or toxic. Toxic substances, e.g., silica, mica, asbestos, talc and portland cement - are more harmful at lower concentrations than are nuisance substances, (State of California Health and Safety Code, Division 20.)

Dust in the Sun Valley area is quite perceptible at various times, casting a haze over the general area. Though perceptible, local sand and gravel has a very low silica content and is not considered toxic in the concentrations measured. See K. W. Nelson, "Public Misconceptions of Air Quality", Pit and Quarry, February 1968, pp. 106-7.

The Bureau of Occupational Health of the County Health Department is charged with responsibility for the work environment, which is generally an indoor environment.

The City Planning Department indirectly exercises control over transportation-borne dust through its regulations over the access routes and their maintenance. Also, the State Public Utilities Commission and the California Highway Patrol have authority to control dust with regulations over the conduct of carriers.

Recently the State Air Resources Board adopted the first set of minimum standards for particulate matter or dust, standards which have been administered by the APCD since July, 1971. The District is currently drafting legislation requiring higher standards of performance to be met by all aggregate processing plants in the County, including those plants which "batch" aggregates for asphalt and concrete. The rule requires the installation of a particular type of dust control system, known as "baghouses". Baggouses capture an estimated 99.2% of the dust released in processing; they are more efficient than water scrubbers and the mechanical collectors which were, in the past, the primary method of dust control used in meeting the standards of the APCD.

Though the scrubbers are 98% efficient in removing dust particles, the remaining 2% is significant. Countywide, there are approximately forty aggregate batching operations, which together produce 20-30 pounds of dust per hour, 6-10 hours per day, often 6 days per week.⁸⁵

Noise and Vibrations

Generally, the noise associated with mining emanates from the truck traffic generated by the activity. The Zoning Code attempts to control the noise and vibrations associated with transportation by controls on the routing and hours of operation. Noise produced by mining equipment, blasting operations and the fixed plant are controlled through regulations on the hours of operation. The standard for regulating noise and vibration are not well defined.

⁸⁵ Personal communication with Mr. Herbert Simon, Senior Engineer, Mechanical Processing Unit, Los Angeles County Air Pollution Control District, May 21, 1970.

Aesthetics: The Zoning Code contains provisions which regulate the appearance of the pits. Recently proposed minimum standards⁸⁶ specify more effective screening or landscaping. The new regulations are generally felt to be satisfactory as concerns the appearance of the pits from the roadway. One of the unresolved, or unresolvable, problems is that the pits are located in the lowlands and are viewable from the residential areas in the surrounding hillsides.

Dust, barrenness, the extensive size and depth of the pits, and/or the aesthetics of the industrial plant and equipment are also offensive to some people. Some of these aspects can be controlled or modified under the police power; others can be satisfied in part with the design and installation of more modern equipment.

Legal Problems: A provision of the present Zoning Code (Section 13.03-D,2) allows the City virtually no control over the operations of non-conforming mining operations, and consequently no control over the environmental aspects of operations which are most offensive, namely, methods and standards of operation:

No provision of this Section shall be construed as limiting or modifying the provisions of any Conditional Use Permit or any other right already existing for the development of rock and gravel granted; or as limiting or modifying production on any property which has prior to the effective date of this Section been zoned as M3; or as limiting or modifying production on any property in respect of which a Court or competent jurisdiction has heretofore issued its Decree permanently enjoining the City of Los Angeles from interfering with such production... In the event of any conflict between the provisions of this Section and the provisions of any such prior M3 zoning or the provisions of any such Final Decree, then in that event the provisions of such Conditional Use Permit or any such prior M3 zoning or of any such Final Decree shall control.

In part, this provision (i.e., Section 13.03-D,2) of the Code is a result of a ruling in the 1950's by the Courts with respect to gravel mining.⁸⁷ Other governmental jurisdictions, for instance the Air Pollution Control District and the Regional Water Quality Control Board, are not restricted by ultra-protective regulations and can adopt and enforce new regulations applicable retroactively where reasonable and in the public interest.

The subject section of the Code as it now reads and is interpreted is not in the public interest. Mining operations in areas rich in resource, such as in the Tujunga Cone, have long economic lives and should not be exempt from modern and reasonable regulations.

The tax regulations applying to the industry are neutral to the objectives of environmental quality. For instance, as the land is mined deeper and deeper, and as the reserves are depleted, the land is appraised at a lower and lower value.⁸⁸ Accordingly, the Federal and State income tax regulations provide for a "depletion allowance."⁸⁹ The depletion allowance, peculiar to all the natural resource industries, has a complicated evolution, but the original purpose was to encourage the exploration of resources so as to meet the demand. The significance of the income tax regulations to the industry was not determined but it appears that these regulations do not encourage environmental conservation. Land reclamation and reuse are as much in the public interest as is the maintenance of metropolitan sources of construction materials. Perhaps the income tax could incorporate a direct incentive for the reclamation of pits; the regulation might be referred to as a "fill allowance."

87 Livingston Rock and Gravel Company v. Los Angeles County, 260 p. 2d 811 (Cal. App. 1953).

88 Personal communications with Mr. Robert Bolles, Deputy County Assessor, Office of the Los Angeles County Assessor, May 21, 1970. See also a discussion of the doctrine of "diminishing assets" in American Society of Planning Officials, Planning Advisory Service, Land Use Control in the Surface Extraction of Minerals. Information Report. No. 153, Part I, Dec. 1961, pp. 11-12.

89 State of California Revenue and Taxation Codes, Sections 24833 & 17687. U.S. Internal Revenue Service Code, Section 613 (B) (6) (K).

CRUDE OIL AND GAS EXTRACTION

The City of Los Angeles has assumed a position of leadership in proposing and implementing regulatory measures concerning oil and gas extraction operations, within the realm of zoning and planning. State and Federal regulation of drilling operations have proved more than adequate in the safety area. This report examines the experience in both these areas and provides some recommendations for improvement.

The Energy Crisis

The major problem concerning the crisis facing the country pertaining to the exhaustion of its energy resources, especially fossil fuels, is not dealt with in detail in the Conservation Plan. This is not due to a lack of concern, but rather to the realization that this is a national and regional problem rather than one that can be dealt with purely on the local level. The City can and should take any and all measures which would reduce waste of these resources. It is so stated in the Plan; however, the formulation of a set of strategies to conserve these resources should come from higher governmental levels.

In the final analysis, national policies applicable to all, not just the citizens of Los Angeles, must be evolved dealing with such as the following:

1. Reduction of the number of motor vehicles using fossil fuels as energy sources;
2. Designing structures in order to better retain heat or retain cool air as appropriate;
3. Developing more efficient engines, and
4. Finding substitute sources of energy. After guidelines for the above are established, it would be appropriate for the City to plan and prepare regulations applicable to the local situation.

A brief history

Oil was discovered in Los Angeles around the year 1890. More than 1000 oil wells were drilled in the

Los Angeles Oil Field, some of which are still producing oil today. The discovery of this oil field precipitated exploration in other areas nearby.

In 1902, the Salt Lake Field located in the vicinity of what is now the La Brea Towers and the CBS Studios was discovered. Approximately 400 wells were drilled in this field and, for the most part, are now abandoned; approximately 23 wells are still in operation. At the same time the Salt Lake Field was discovered some production was established in the Beverly Hills area. With the oil discoveries in Beverly Hills, Newport, and other areas, it became evident that the Los Angeles basin would prove to be one of the world's great petroleum producing regions.

In 1930, the Venice Oil Field was discovered and in 1936 oil was found beneath lands controlled by the City's Board of Harbor Commissioners in Wilmington. Some 1200 wells were drilled in Wilmington field.

In 1953 oil deposits were found in the old Beverly Hills field and in Cheviot Hills, where large quantities of oil have since been extracted. Other discoveries in the urban portions of the City, bypassed before because of their populated character, have since been exploited, including the La Cienega gas-oil field and a field under City Hall.

In the City of Los Angeles during the fiscal year 1971-72, 18,730,000 barrels of oil and 24,438,000 million cubic feet of gas were produced from 1795 wells. Twenty-nine new wells were drilled during this period and six were abandoned.

In the last several years, a steady decline in oil and gas production has been evident. Table 9 illustrates this:

TABLE 9

<u>Year</u> <u>(Fiscal)</u>	<u>Oil (bbls)</u> <u>Production</u>	<u>Gas (Mcf)</u> <u>Production</u>	<u>% decrease in</u> <u>oil production</u>	<u>% decrease</u> <u>in gas prod.</u>
1968-69	25,867,000	45,822,000	-	-
1969-70	24,550,000	43,639,536	5%	4.8%
1970-71	20,566,000	33,478,000	16.2%	18.4%
1971-72	18,730,000	24,438,000	8.9%	27.1%

In the last four years decreases of 27.6% in oil and 46.6% in gas production have occurred. Should this downward trend continue, the significance of oil extraction within the City may prove to be of minimal importance in the long run.

The City receives significant revenues from oil and gas production. In 1971-72, \$1,068,410 was received as tax revenue while another \$628,953 was received from lease, bonus, rental, and royalty income from city-owned lands as well as for permit and application fees for a total of \$1,697,390. In addition, approximately 800 jobs are related to oil and gas production in the City.

City-owned Oil Producing Lands

The City presently owns some land upon which royalties are accruing as a result of oil extraction operations. The City, as a land owner where oil is produced, is in a somewhat different role from that where it is just applying its police powers. For the most part, leases to oil operations extracting oil from city lands contain language which transfers most liability from those operations to lessee, requires the lessee to exercise reasonable care and diligence, requires that the lessee maintain adequate insurance against public liability and property damage, and requires that the lessee comply with present and future valid laws and regulations. These rules appear to have been adequate.

Regulation

Public regulation of oil drilling operations under the police power generally fall into two areas, (1) health and safety regulations and (2) those regulations having to do with planning and zoning considerations.

Safety Regulations: The City regulates oil drilling and associated operations from a safety context through fire code, building and safety codes and Department of Water and Power regulations. The Fire Department requires certain types of blowout preventers be installed and maintained. Also, the Fire Department requires that certain procedures be followed and equipment installed in order to be certain that adequate protection from

possible fires is provided. Fire Department regulations do not relate to drilling and casing practices which an operator must follow in the course of drilling and completing wells.

Regulations of the Department of Building and Safety are directed only toward buildings and structures which accompany drilling operations rather than to drilling operations themselves. If it is held desirable, it is felt that the Department could exert its authority in connection with the approval of drilling and casing programs in oil wells.

The Department of Water and Power (DWP) now certifies as to the proper depth of the well casing, proof of "water shut-off" of subsurface aquifers, and compliance with other prescribed drilling practices intended to prevent contamination of underground fresh water supplies. Before granting certification, the DWP takes an electric log to a depth of 2,000 feet to determine possible groundwater pollution hazards.

The State of California regulates oil well drilling operations through the California State Division of Oil and Gas, a subsidiary organization of the Department of Conservation. The primary purpose of this regulatory activity is the protection of the public water supply.

Section 3219 of the State Public Resources Code states:

Any person engaged in operating any oil or gas well wherein high pressure gas is known to exist, and any person drilling for oil or gas in any district where the pressure of oil or gas is unknown, shall equip with casings of sufficient strength and with such other safety devices as may be necessary in accordance with methods approved by the Supervisor and shall use every effort to and endeavor to prevent blow outs, explosions, and fires.

Section 3203 of the Public Resources Code requires the owner or operator of any well to file with the State a Notice of Intention to commence drilling. A substantial amount of information is required as

a part of this notice, including the expected size and weight of casing to be used and the depth where production is expected. A specific set of conditions or explicit conditions, however, do not exist. Reliance for adequate control is placed upon the judgment of State officials to determine whether or not a safe drilling and casing program is contemplated or implemented. These State controls are applicable to the City.

The City, State and Federal governments all own or control lands upon which oil drilling and production on a lease basis take place. Each jurisdiction has special requirements related to oil drilling and production of a more restrictive nature than those placed on private properties.

Perhaps the best way to evaluate the adequacy of these regulations is performance. Since the advent of modern drilling operations in the City (post 1953) approximately 350 wells have been drilled. With only three exceptions, no incident has occurred and no damage has ever occurred beyond the walls of the drill site.

Many people cite the now infamous "Santa Barbara Oil Spill" as an example of what can happen. This well, completed in an area under Federal jurisdictions, probably would not have failed had normal procedures been followed. Had surface casing from 1,000 to 1,200 feet been provided and had the mud tanks been adequately observed, quite probably, no oil spill would have occurred. Arthur Spaulding, City Oil Administrator, in his report to the City Council on the Santa Barbara spill leads us to believe that had "normal" precautions been taken, such as those taken here in the City, such an incident would not have taken place.

In conclusion, it seems that adequate safety measures are being taken with respect to oil well drilling and production operations in the City. However, men and equipment are fallible, and unless a complete shutdown of operations is ordered, some accidents may occur. With adequate controls, it is felt here that chances of these accidents occurring have been minimized.

Zoning and Planning Regulations: A valid power of the City is to control the conditions under which oil and gas may be extracted from the ground in order to provide for the most appropriate use of land, to conserve and stabilize the value of property, to provide adequate open spaces for light and air, and, especially, to promote the public health, safety and general welfare. The City's zoning regulations concentrate on the physical-spatial land use aspects of oil extraction.

The City of Los Angeles was one of the first communities to experience rapid exploitation of oil resources in totally selfish, thoughtless, inefficient, unsightly and destructive methods employed by the early oil drilling and producing companies.

As a result of these practices, a long struggle occurred where the City gradually enacted regulations designed to ensure compatibility of these operations with orderly urban development and desirable community environment. Now these regulations are cited as a model for other municipalities to follow.

The Plan document includes a series of policies and standards which, for the most part, are derived from these regulations. A detailed discussion of these regulations, since they already are law, is not included here. The basic principles behind these regulations are discussed.

Most of the City's zoning and planning regulations are directed towards minimizing the detrimental environmental effects of oil drilling on the surrounding community. City regulations pertain to the following:

- (1) Limiting the number of drill sites;
- (2) Screening the drill sites and associated operations from view as well as ensuring that the facilities blend in with the surrounding community;
- (3) Minimizing the sound of operations;
- (4) Minimizing traffic generated from oil drilling operations, and
- (5) Repressurization or halting of operations should subsidence be a problem.

The City's regulations have evolved over many years and are stringent. They have, however, been made possible through advances in technology. A continuous monitoring of technological advances by the City should provide a basis for development of additional requirements aimed at creating a safer and more pleasing environment, while still allowing citizens to enjoy the benefits derived from oil extraction. Some concerns which became evident as part of this study are discussed below.

Urbanized vs. Non-Urbanized Areas: Section 13.01 of the Planning and Zoning Code differentiates between urbanized and non-urbanized areas. Urbanized area controls on oil drilling operations are more stringent than in non-urbanized areas. Non-urbanized areas include areas in the M3 Heavy Industrial Zone and other land specifically designated by the City Council as non-urbanized. A Plan proposal is that all land within the City be considered as urbanized.

An oil drilling district in a non-urbanized area is a minimum of one acre in size. However, no more than 2 drill sites may be located in one City block. In urbanized areas, the minimum size oil drilling district is 40 acres. Additionally, screening of drill sites and other aesthetic controls are less stringently applied than in an urbanized area.

At one time, vertible forests of oil derricks and wells were considered necessary by oil drilling companies as the only means of getting their profit from oil extraction operations. The law in the State of California supported this chaotic situation by permitting the application of the "rule of capture" law. Today a "correlative rights" application of the law is used. Essentially, all property owners get a percentage of oil royalties from producers which is felt to represent the amount due them from oil taken from below their lands.

The technology associated with oil drilling now permits slant drilling and strict production controls. Now, considerable monies in terms of equipment and labor costs can be saved by limiting the number of wells drilled.

Considering all these factors, a fair means of distributing oil royalties, improved oil producing technology,

favorable cost factors, and the desire for a better environment leads us to the conclusion that it is to the advantage of City and oil producer alike to eliminate the distinction between urbanized and non-urbanized oil districts in favor of one set of regulations: those applying to urbanized areas.

Repressurization: The Plan includes a proposal that all oil fields be repressurized as a means of preventing subsidence. The Code now indicates that, should the City Administrative Officer report and recommend that oil drilling and production activities have caused or may cause subsidence in the elevation of ground within the district in an urbanized area or in the immediate vicinity, that the Zoning Administrator, after checking with additional experts, may require that corrective action be taken including repressurization or cessation of operations.

For the most part, significant settling of ground in the City has been a result of oil extraction. One possible exception is the failure of the Baldwin Hills Dam. As a result of repressurization after subsidence had occurred, it resulted in extensive loss of property and life. The Long Beach area experienced subsidence as a result of oil removal of twenty to thirty feet which was stopped only when water injection took place over a period of several years. Enormous costs resulting from repairs to utilities and structures resulted from this subsidence.

Quite possibly, there is little likelihood of subsidence in Los Angeles. However, the following should be considered:

- . Repressurization probably will be accomplished at some time in the future in order that secondary recovery of oil may be accomplished, and
- . The threat to life and property, not to mention costs should subsidence occur, may be such that not even a very slight risk should be assumed. If there is no threat that underground aquifers would be contaminated from sea water, then a

ready source of water exists. Otherwise, fresh water sources should be utilized.

Should water injection, for some reason, prove not to be feasible, consideration should be given to bans on some or all future development in possible subsidence areas.

Also, a problem has been the disposal of oil brines. Presently some brines have been dumped into the City sewer and storm drain systems. Water pollution is a direct result of these practices. In the City, these practices have been reduced and it is anticipated that, in the future, they will be halted as a result of pressures from the State Water Quality Control Board.

Oil Drilling Off-Shore and in Beach Areas

Located in the San Pedro Harbor, Venice and adjacent to the Pacific Palisades are oil fields which extend into beach and off-shore areas. The establishment of these areas as oil districts has occasioned a considerable amount of controversy. Arguments against oil production are summarized below:

The California coast line is a precious national resource which must be protected with diligence and care. The short term economic gains which might derive from oil development do not justify the erection of oil rigs or other activities associated with oil production which would be completely incompatible with the best land use pattern for these areas. The threat of pollution from both offshore drilling, as well as slant drilling from sites adjacent to the ocean, is cited.

The Plan includes a recommendation that drilling operations be banned off-shore and on beaches. Eventually, it is hoped that the ban can be extended to include a strip of 1/4 mile inland from the nearest road or alley easement adjacent to the beach. The City Council voted once to ban oil drilling on the beaches and on the 1/4 mile strip inland from the mean high tide line, which was vetoed by the Mayor.

By extending the ban to all areas off-shore within the City's jurisdiction the City will effectively protect itself from disastrous occurrences, however remote the possibilities of occurrence.

Further, the unsightly "islands" or oil drilling platforms used to extract oil from fields located beneath the sea mar the beauty of the local coast line. Inasmuch as millions of citizens utilize beaches for recreation and relief from the urban environment in the hotter months, it would be improper to impose visual blight on their experience. Further, Southern California beaches have been a great tourist attraction. It would be unfortunate if such a resource would be diminished by imposition of these unsightly platforms.

It seems important that the City take heed to the warning of Dr. Norman K. Sands, a professor of Geography at the University of California at Santa Barbara:

The sequence as it took place in Santa Barbara (and several other locations) is as follows: First wells on shore tapped the edge of an offshore oil pool. Then, in order to produce the field with maximum efficiency, piers were built out into the ocean and wells drilled from them. Then platforms were built to more efficiently utilize the resource. In Santa Barbara's case, the oil pool extended past the three mile limit into federal waters. This prompted the Federal Government to grant leases to build more platforms to keep all the royalties from being taken by the state. (Oil was slowly migrating from under the Federal lands, toward the wells inside the three mile limit.) Right now, the line of platforms which is marching across our channel is approaching the sanctuary in front of Santa Barbara. One of our fears is that the Federal lease platforms will start pulling oil from under the sanctuary which will prompt the revenue hungry state to allow drilling there, thus completing the cycle.

In summary, the slant drilling in itself may or may not be a pollution threat. What will probably follow slant drilling (piers, state and federal platforms) will pose a major danger to the ecology and esthetics of the area.

I hope that you can save your community through pointing out how the industrialization of the Santa Barbara Channel came about. It took Santa Barbara years to realize the enormity and performance of what the oil companies were doing to the area. Once they get a toe-hold through slant drilling, your battle will be lost.

As of this writing, the Coastal Zone Conservation Act has been passed by the California electorate. This Act creates a South Coast Regional Commission as well as a California Coastal Zone Commission which have the responsibility for planning for the coastal zone through 1976. These bodies also must issue permits for any development projects within 1,000 yards of the beach. The coastal zone and permit area would, generally, encompass all the area proposed in this Plan for a ban on oil drilling. One may assume that considerable pressure will be placed on those bodies to prevent oil drilling. Because of the 2/3 vote required for those commissions to approve development permits, it would seem unlikely that oil drilling operations will be allowed in the near future in any case.

Disclosure of Operations and Impact on Environment

The State Environmental Quality Act of 1970, as amended by AB 889 in December of 1972 and as interpreted by the Courts (Friends of Mammoth vs. Mono County) seems to require environmental impact reports for conditional use permits allowing oil drilling districts and core hole operations. As a result of this study, it cannot be overemphasized that there is a necessity for public officials to know the full impact of proposed oil drilling and extraction activities. The Environmental Impact Report requirement should fulfill this need. Should it become necessary that the City provide guidance in preparing these reports, at a minimum the following should be fully examined:

1. The extent of immediate and potential future operations,
2. Visual impact of operations and means to be taken to minimize this impact,
3. Impact of noise created by operations and means taken to minimize this impact,

4. Potential pollution of ground water and means for preventing same, and
5. Potential for subsidence and means to be taken to prevent or reduce risk of subsidence.

City Procedures

The City Planning Commission and City Council are responsible for establishing oil districts for the purpose of conducting production activities. The Zoning Administrator has the authority to prescribe the conditions controlling drilling and production operations. The City Administrative Officer recommends and reports on all proposed oil drilling and production activities to the Zoning Administrator.

Similarly, the Assistant City Administrative Officer in charge of petroleum administration reports to the City Planning Commission and the Council on proposed oil districts.

CHAPTER VIII

ARCHAEOLOGY AND PALEONTOLOGY

Archaeology

Archaeology is that discipline concerned with the life and culture of ancient peoples as indicated by extant traces of their works. In contrast with other pre-Columbian peoples, the local Shoshone Indians were simple folk. Compared to the edifices of the Aztecs, Pueblos and even those of the Pacific Northwest Indians, works of the local Indians are relatively minor. For this very reason, the remains of the locals is a delicate resource that is easily destroyed.

The UCLA Archaeological Survey has identified several hundred sites of archaeological significance in Los Angeles County. A relatively small number of these sites are in the City of Los Angeles. These have been delimited on U. S. Geological Survey topographic maps at a scale of 1:62,500.

Paleontology

Paleontology is the science concerned with the study of pre-historic life as expressed through fossilized plants and animals. Fossil remains have been found with some frequency in a number of locales within the City. Most frequently, these finds are associated with excavations for large buildings or public works projects or subdivisions involving grading.

Although public works agencies and some private developers have afforded opportunities to paleontologists to study their project sites, this consideration is by no means prevalent. It is a recommendation of this Plan to require notification of the Cultural Heritage Board in the event such a finding is made. The Board has immediate access to scientific teams that can assess the importance of the find and minimize any construction delay.

Conclusion

The City is a trustee of the environment. As such, it has a moral obligation to preserve, to the extent feasible, those ancient and irreplaceable works of man and nature as may from time to time be discovered.

CHAPTER IX

COASTLINE EROSION

Distribution

The Coastal periphery of the City of Los Angeles is approximately 13 miles in length, of which approximately 9-1/2 miles can be classified as sandy beach and approximately 3-1/2 miles as narrow, wave-cut terraces at the bases of sea cliffs.

This distribution is typical of most of the coastline of Los Angeles County. The coastline is "fronted" by a number of jurisdictions in addition to the City of Los Angeles, including the County of Los Angeles and the Cities of Santa Monica, El Segundo, Manhattan Beach, Redondo Beach, Hermosa Beach, Torrance, Palos Verdes Estates and Rolling Hills.

Erosional Processes

The marine erosional cycle along the southern Los Angeles County coastline results from wave action upon an emergent plain southerly of the Santa Monica Mountain system. The topographic expression is characterized by steep palisades in the northern portions, in some cases with wide sandy beaches, in others with only narrow wave-cut terraces. The southern portions, beginning at about Redondo Beach, are characterized almost exclusively by the latter.

The local coastline is affected by several variants within the marine erosional process. The entire coast of California is swept by the California Current setting from the north (being a tributary of the trans-Pacific Kurosiwa or Japanese current). Where this current impinges upon the land, deviations from the prevailing direction occur. The latter is one of the important causative factors behind the predominant longshore (or littoral) current. The predominant longshore current in this area, setting from the north, is also largely abetted by the oblique breaking storm-generated wave-fronts setting from the northwest. These long-shore currents do not produce as significant erosive actions as are generally alleged, however, and their effects are largely confined to a zone between the breaker-line and the 50-fathom line. More

significant is terms of specific erosional process on the beach is the phenomenon of "beach drifting" first described by Johnson (1919).⁹⁰

If a wave approaches a shore obliquely, its swash will run up the shore in the direction of wave propagation, but its back-wash will move down the steepest shore under the influence of gravity. This is usually at right angles to the shore and consequently particles being moved between swash and back-wash...move...along shore in a direction parallel to the front of the breaking waves. The local beach drifting coincides generally with the direction of the long shore current⁹¹ producing pronounced movement of shore materials. Although non-synonymous, the term "beach drifting" is subsumed under the general term "longshore current, or drifting."

The foregoing is the predominant form of erosion affecting the local coast line. The shoreline appears to be of the emergent type, evidenced by the occurrence of ancient wave-cut terraces at varying levels as on the Palos Verdes Peninsula.

Beach Sand Supply

In addition to locally-produced particulate matter,⁹² the coastal beaches in the past have obtained the majority of their sand in the form of wave-caused deposition of material that had been transported down intermittent streams during the rainy winter months.

The construction of large-scale flood control facilities inland, especially debris basins, have significantly reduced the amount of detritus arriving at the mouth of the streams. Accordingly, a severe diminution of new sand has resulted.

⁹⁰ Thornbury, W. D. Principles of Geomorphology, 1954, p. 430

⁹¹ There are some localized conditions where counter long shore currents produce atypical, and often ephemeral beach forms.

⁹² Formed by wave action upon the shore.

Protective Measures

The scarcity of beach-forming material has led to severe denudation of existing beaches on many occasions. To minimize the effects of this process, the City, the County and the Corps of Engineers have at various times since the 1940's, erected various structures at locations along the coast to control erosion. These devices either totally interrupt or allow controlled flows of detritus suspended in the longshore current.

The placement of any kind of coastal structure has both beneficial and detrimental effects upon the beach, both up-coast and down-coast. The construction of groins benefits the beach up-coast by trapping sediments in the longshore current, thereby aiding the process of beach building. Immediately down-coast of the groin, denudation is the usual result due to the diminution of transported sediments. This condition necessitates the placement of a series of groins. The topographic expression in such a regime is not unlike a stairway viewed on edge.

Breakwaters are often constructed to protect beaches from the direct assault of wave action. In some instances, as at Santa Monica Harbor, breakwaters also afford a measure of protection to what might otherwise be an open roadstead-type of small boat anchorage. The shielding effect of breakwaters slows down waves such that they lose their sediment-carrying ability some distance off-shore. The resultant deposition forms a type of spit or bar known as a tombolo. This beach-building process is beneficial except insofar as it shoals a small boat anchorage such as Santa Monica Harbor.

Where a stream empties into the ocean (e.g., Ballona Creek) a pair of jetties are often constructed. Their two principal benefits are prevention of channel shoaling and beach-building up-coast (like that of an imperious groin). Normally, the down-coast side experiences the denudation of beaches characteristic of the groin experience. There is at least one local exception. The beach immediately southerly of the Ballona Creek jetty has formed half of a bi-furcated tombolo behind the Marine del Rey Channel breakwater.

CHAPTER X

AIR QUALITY

The occurrence of air pollution is dependent upon the simultaneous occurrence of a number of conditions, the effects of which are compounded by their co-existence. These conditions or factors may be divided into two major categories: (1) Emissions and (2) meteorological factors. If factors in either category are such as to discourage the accumulation of air contaminants, there is no problem. But when factors in both categories simultaneously enhance the accumulation of air contaminants, the probability of adverse health effects due to air pollution increases -- definitely to a disagreeable and perhaps even to a potentially dangerous degree.

Air pollution results when the atmosphere in a given location can no longer remove or disperse the contaminants with which it is continuously being charged. Certain areas, because of their location and prevailing meteorological conditions, can tolerate a far greater relative quantity of emissions to the air than others. This is so because their ventilation is such that contaminants are removed from the area by winds or by diffusion at a rate far greater than that at which they are introduced. As a result, no accumulation of pollution is possible and no problem exists. On the other hand, when the emission of contaminants into the air occurs at a rate which exceeds the ability of the air to dispose of them, the contaminants accumulate and certain objectionable effects attributable to air pollution may be experienced.

Emissions

The source of air contaminants can be divided into two basic groups: Stationary and mobile. The contaminants can be gases or particulates, organic or inorganic.

In terms of quantities, transportation-oriented emission sources are by far the most serious in Los Angeles County. They include gasoline and diesel-powered autos and trucks, ships, railroads and aircraft. According to the latest available information, these sources together currently emit 1,700 tons per day of hydrocarbons and other organic gases, of which only 1,200 tons are of the reactive variety (i.e., those that help in the formation of smog), 9,095 tons per day of carbon monoxide,

770 tons per day of oxides of nitrogen, and 40 tons per day of particulate matter. This comes to 12,875 tons per day which is equivalent to 89.7% of the total 14,355 tons emitted to the basin's atmosphere each day from all sources in 1971.⁹³ The remaining 1,480 tons per day come from industrial and commercial sources located within the County.

Motor vehicles are the principal sources of the three main gaseous pollutants -- hydrocarbons, carbon monoxide, and oxides of nitrogen. Almost 98% of the carbon monoxide (CO) released into the Los Angeles atmosphere is from gasoline-powered vehicles. On the average, 29 pounds of CO are emitted per ten gallons of gasoline consumed.

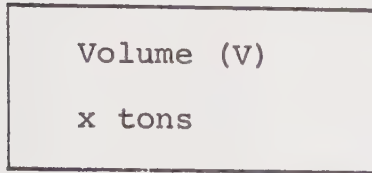
Meteorological factors

The meteorological factors most important to the creation of an air pollution problem in the Los Angeles area stem primarily from the frequent occurrences of persistent temperature inversions. A temperature inversion is formed when, as a result of atmospheric factors such as pressure changes over an extended area, the air at some distance above the ground is heated to a higher temperature than the air immediately below it. When this happens, the air at ground level, which usually diffuses upward in an unrestricted manner, is limited in its upward diffusion at the base of the inversion layer. Thus, a quantity of emissions which might normally be distributed to heights above 5,000 feet are confined to within 500 feet of the ground, or even less. As a result, the concentrations of the contaminants are increased by a factor of 10 (all other conditions being equal) because of the smaller volume of "mixing air".

When an inversion exists, wind speeds, which depend on free movement of the air, are also reduced. Wind speed is the most important micro-meteorological or local area determinant of pollution accumulation in a region of ordinary emissions. When wind speeds drop below 8 miles per hour, pronounced reductions in visibility occur in urban areas. Decreased wind speeds, in turn, contribute to the development of higher temperatures as the earth is heated by sunlight irradiation, leading to heat accumulation over the area. Thus, the high surface temperatures which frequently occur in late summer and early fall are the direct result of the temperature inversion which persists above and low wind speeds in the air below the inversion and at the earth's surface. Perhaps a pictorial representation would better explain this phenomenon.

Figure 11

Normal Condition (No
contaminant buildup)

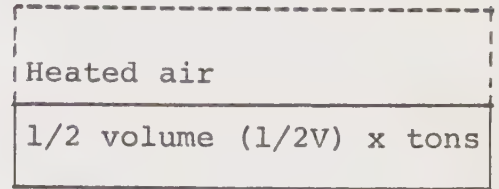


Ground level

$$\frac{x}{V} = \text{air quantity}$$

Vertical
mixing

Inversion Condition
(contaminant buildup)



Ground level

$$\frac{x}{1/2 V} = 2 \frac{x}{V}$$

Resulting in same amount of emissions being diluted by 1/2 the volume of "mixing air".

Air Pollution and City Form

Conservation of air must be given a high priority in community and industrial planning; air is significantly affected by modes of construction, density and height of buildings, location of parks, types of vegetation, traffic movements and the like.⁹⁴ City structure and form can contribute to or ameliorate air pollution problems. The impact of air pollution can be altered by every building and street that is constructed, since these elements affect wind patterns and speeds and temperatures.

Buildings in different topographical locations are subject to different microclimates and are associated with varying

⁹⁴ C. Peter Rydell and Gretchen Schwarz, "Air Pollution and Urban Form: A Review of Current Literature", Journal of American Institute of Planners, March 1968, pp. 115-120.

concentrations of pollutions. On the plus side, canyon-like rows of tall buildings, strategically placed, can create a funnel effect, frequently doubling the wind speed. At night, heat losses are greater at higher floors of tall buildings than at lower ones. These temperature variations create upward currents in the city streets which can act with the high Velocity winds to sweep pollution away.

On the negative side, large areas of rooftops of the same height can create an inversion layer over themselves, thereby contributing to the air pollution problem. High-rise buildings utilizing acres of glass immediately place a burden on energy requirements for cooling and heating. Evaluating the projected imbalance between anticipated demand for and supply of electrical energy, it is likely that there will be a time when a limited number of kilowatts will be assigned to any single building before a permit would be issued. The owner and architect will have to decide upon tradeoffs between lighting, equipment and air conditioning to keep within an overall energy budget.

Certain changes could be made in building design and construction that would reduce the energy required to construct and maintain buildings by at least 25 percent.⁹⁵ Tests and studies exist that indicate present lighting standards may be too high for performance of tasks in office buildings, for instance. Sometimes high levels of light are recommended only for the ambience or impression they create, i.e., for cosmetic effect. These tests have indicated that adequate lighting could be installed in institutions, commercial buildings, schools and so forth that would require less than 50 percent of present light loads. This does not include the additional savings that could be realized by installing more selective switching arrangements or by eliminating electrical light usage when adequate daylighting exists; nor does it take into account the air conditioning savings that would result if buildings no longer had to compensate for the heat that unnecessary lights create.⁹⁶

⁹⁵ Richard G. Stein, "A Matter of Design", Environment, October 1972, p. 17.

⁹⁶ Ibid. p. 25.

The savings available by reducing night lighting for advertising purposes merits exploration.

Methods of moving traffic most definitely can add to pollution problems. New highways through mountains can create alleys in which cold air and pollution can settle. Such considerations must be evaluated before freeways are built through the City's mountains. Streets and highways should be designed to minimize "stop and start" traffic. Traffic should be maintained at steady low-emission speeds. The Department of Traffic is in the process of implementing a citywide master signal interconnection. Of the 3,264 traffic signals within the City, 1,775 signals are now interconnected. Eventually 43 systems will cover the entire City and will operate on a variety of computerized programs to accommodate morning and evening peak travel hours and commuting patterns.

Only air beneath the inversion layer is available to absorb pollutants. The air inversion has a tendency to rise as the City heats up during the day. The observation of this phenomenon has led two meteorologists to recommend changing the summertime peak traffic hours by delaying the morning rush by one hour to take advantage of the optimum conditions of turbulent mixing.⁹⁷ They estimate that this would result in a 24 percent decrease in air pollution as measured by oxidant concentrations. Inasmuch as the warm months are those in which pollution is heavily concentrated, do citizens fully realize the impact that daylight saving time has on exacerbating the concentration of air pollutants? Should daylight saving time be dropped in exchange for better health effects? Can alternatives result in accomplishing the end result of delaying peak traffic loads?

Narrow open space buffers between incompatible land use do not contribute to pollution dilution, their small size makes them ineffective for this purpose. Where possible, these buffers should be over 150 feet in width.

⁹⁷ Erwin K. Kauper and Charlotte J. Hopper, "The Utilization of Optimum Meteorologic Conditions for the Reduction of L. A. Automotive Pollution", Air Pollution Control Association Journal, Vol. 15, No. 5, May 1965, pp. 210-213.

The U. S. Forest Service has been conducting tests on the cleansing effect trees have on polluted air.⁹⁸ These tests have shown that trees nearest highways have more lead and metallic dusts on their leaves than do trees farther away. The indication from such test findings is that trees can be instrumental in preventing the spread of such pollutants over the general area. Further research will be conducted into the part trees may play in physical and chemical absorption of various pollutants dangerous to human health.

DETERMINATION OF STANDARDS

The responsibility for the abatement of air pollution is vested in several agencies. The Los Angeles County Air Pollution District is responsible for controlling stationary sources of smog. Control of motor vehicle emissions is under the jurisdiction of the State Air Resources Board. The responsibility for the control of aircraft emissions will be vested in the Federal Aviation Agency, utilizing standards and criteria set forth by the Environmental Protection Agency.

Air Quality Criteria

Prior to setting or establishing standards, it is first necessary to determine air quality criteria. These criteria define the relationship between concentrations of pollutants, duration of exposure and effects on health and welfare. As explained by the United States Public Health Service,⁹⁹ criteria are derived from known toxicological dose-response relationships and threshold-limit values, as well as from the results of air pollution medical research.

Air Quality Standards

Based on the criteria, standards represent the limitations to be placed on concentrations of pollutants in the air. These limitations may be used as single maximum allowable concentration values or as allowable averages or ranges of frequency distributions.

The Technical Advisory Committee of the California Air Resources Board identifies two categories of air quality

⁹⁹ Department of H.E.W., Public Health Service, Air Quality Criteria for Sulfur Oxides, PHS No. 1619, 1967.

standards:¹⁰⁰ Those based on health preservation, for which there should be no compromise for reasons of economy or convenience and those based on aesthetic values and the protection of property which must reflect the judgements of the community in which they are applied.

Standards are set for the following pollutants on the basis of health effects: nitrogen dioxide, carbon monoxide, oxidant, sulfur dioxide, hydrogen sulfide, particulates, and lead. Visibility-reducing particle and hydrocarbon pollutants are classified as not directly affecting health. As an example, the proposed air quality standard for oxidant in California of 0.1 ppm for 1 hour is based on the production of eye irritation and possible impairment of pulmonary function in persons with respiratory disease. The studies on which this standard is based are epidemiologic and which have been supported toxicologically.¹⁰¹ The proposed standard for nitrogen dioxide at 0.25 ppm for 1 hour is based on findings obtained by toxicologic studies on animals.

The Federal Clean Air Act of 1970 requires the Environmental Protection Agency to set national air quality standards. In the past, California's standards have been more strict than those on the national level. However, Table 10 indicates that this trend might be reversing; the establishment of these levels represents virtually the first attempt to protect those citizens who are particularly sensitive to air contaminants, i.e., those citizens already afflicted with cardio-respiratory problems. Standards were previously set on what was technically feasible; now, human requirements have been considered.

The Prognosis for Achievement of Standards

Statements made in the annual reports of the California Air Resources Board (ARB) are all optimistic in their

¹⁰⁰ Technical Advisory Committee to the California Air Resources Board, Recommended Air Quality Standards Applicable to All Air Basins, Sacramento, Sept. 1970

¹⁰¹ Peter K. Mueller and Margaret Hitchcock, "Air Quality Criteria - Toxicological Appraisal for Oxidants, Nitrogen Oxides, and Hydrocarbons", Air Pollution Control Association Journal, Sept. 1969.

Table 10

<u>Substance</u>	<u>Present Calif. Standard</u>	<u>Recommended Calif. Standard</u>	<u>EPA Standard</u>
Oxidants	0.1 ppm; 1 hr. avg.	0.1 ppm; 1 hr. avg.	0.08 ppm; 1 hr. avg.
Sulfur oxides	0.04 ppm; 24 hr. avg. 0.50 ppm; 1 hr. avg.	0.08 ppm; 24 hr. avg. 0.50 ppm; 1 hr. avg.	0.14 ppm; 24 hr. avg. 0.03 ppm; annual arith- metic mean
Nitrogen oxides	0.25 ppm; 1 hr. avg.	0.25 ppm; 1 hr. avg.	0.05 ppm; annual arith- metic mean
Carbon monoxide	10 ppm; 12 hr. avg. 40 ppm; 1 hr. avg.	10 ppm; 12 hr. avg. 40 ppm; 1 hr. avg.	9 ppm; 8 hr. avg. 35 ppm; 1 hr. avg.
Particulate	60 $\mu\text{g}/\text{m}^3$; annual geometric mean 100 $\mu\text{g}/\text{m}^3$; 24 hr. sample	60 $\mu\text{g}/\text{m}^3$; agm 100 $\mu\text{g}/\text{m}^3$; 24 hr. sample	75 $\mu\text{g}/\text{m}^3$; agm 260 $\mu\text{g}/\text{m}^3$; 24 hr. sample
Hydrocarbons	covered by oxidant standard	covered by oxidant standard	0.24 ppm; 3 hr. avg. (6-9 a.m.)

Sources: Technical Advisory Committee to the California Air Resources Board,
Recommended Air Quality Standards Applicable to All Air Basins, p. 2

Environmental Protection Agency, Press Release, April 30, 1971

$\mu\text{g}/\text{m}^3$ = micro (millionths of) grams of pollutant in a cubic meter of air

ppm = parts of pollutant in a million parts of air

outlook on emission control. The Federal Pure Act of 1968 specified a time-table to be met with respect to carbon monoxide, hydrocarbons and oxides of nitrogen. As a result of this timetable, the first evaporative control for hydrocarbons and carbon monoxide went into effect with the 1970 model automobiles sold in California. The strictest standards for exhaust hydrocarbons in the Pure Air Act of 1968 did not go into effect until 1972, and those for oxides of nitrogen will not be in effect until 1974. These controls are predicted to progressively reduce the emissions of all three pollutants to a minimum point of about 1985.¹⁰²

Meeting these goals is predicated upon the ability of vehicles to meet the required standards throughout their lives. Unfortunately, surveillance of vehicles with exhaust controls has indicated that vehicles in general use have higher hydrocarbon emissions than do those in the fleets tested for certification.¹⁰³

It is interesting to note that pre-1966 vehicles account for about 50 percent of California's vehicle population. Because of their ages, and because many are in poor mechanical condition, emissions from these vehicles represent more than one half of the total motor vehicle emissions.¹⁰⁴ Emission standards for these cars are not as stringent as those for new vehicles. In addition, there are several classes of vehicles that are not subject to emission controls: off-highway vehicles and equipment, most of which are diesel-powered; motorcycles; boat motors; and other small engines. Additionally, control of emissions from aircraft is preempted by the Federal government; enforceable regulations will not be in effect prior to January 1, 1974.

In sum, emission projections appear to be overly optimistic, in view of the facts that:

- . the attrition rate for pre-1966 vehicles is extremely slow;

¹⁰² Air Resources Board, State of California Resources Agency, Annual Report 1968, pp. 26-27

¹⁰³ Ibid.

¹⁰⁴ Air Resources Board, State of California Resources Agency, Annual Report 1970, p. 40.

- . the efficiency of currently-used crankcase devices decreases over time; (If they are not properly maintained, not only do they not reduce emissions, they may cause serious damage to the vehicle's engine thereby increasing quantities of air pollutants).
- . there is expected to be a continuous increase in motor vehicle registration to 1990;
- . certain classes of vehicles are currently exempt from control; and
- . local air pollution control districts have no control over standards set for aircraft emissions.

Therefore, there seems to be some inconsistency in logic when the ARB can predict more and more vehicle registrations, but fewer overall emissions. This is based, of course, on the major assumption that standards for automobiles must continually be revised downward (made more stringent) to allow for the higher production rate of autos.

It is quite obvious that merely instituting tougher standards will not solve the air pollution problem. Over the years, standards have been tightened; in the past they were set on the basis of what was technologically feasible. Table 11 indicates on how many days State standards were exceeded in Los Angeles County. This may have been due to meteorological conditions that resulted in decreased volume of mixing air, excess emission levels or combinations of reasons. The important thing to note is that no matter what the standards are, there will be days on which they will not be met in Los Angeles County.

Steady deterioration in the Nation's air quality and the inability of local jurisdictions to cope with the air pollution problem are major reasons why Congress passed the Federal Clean Air Act of 1970. This Act mandated the Environmental Protection Agency (EPA) to set standards for the various national air basins. The individual states were required to submit plans by which they intended to meet these standards by 1975 (or 1977 at the latest). The California Air Plan has not yet been accepted by the EPA.

TABLE 11
NUMBER OF DAYS STATE STANDARDS WERE EXCEEDED
IN LOS ANGELES COUNTY

<u>Year</u>	<u>CQ</u>	<u>NO2</u>	<u>Oxidant</u>	<u>Particulate</u>	<u>SO</u>
1960	20	112	236	180	60
1961	20	101	212	169	63
1962	19	85	225	211	60
1963	35	79	191	167	35
1964	19	78	179	131	28
1965	58	100	190	153	86
1966	23	86	217	173	124
1967	26	113	209	190	100
1968	6	132	188	166	114
1969*	171	102	246	328	68
1970*	203	115	241	335	95

Note: 1967 California Standards were:
CO - 30 ppm for 8 hr. or 120 ppm for 1 hr.

NO2 - 0.25 ppm for 1 hr.

Ozone - 0.15 ppm for 1 hr.

Particulate matter - sufficient to reduce
visibility to less than 3 miles when
relative humidity is less than 70%.
Standard increased to 10 miles in 1970.

1970 California standards were:
CO - 10 ppm for 12 hrs.

NO2 - 0.25 ppm for 1 hr.

Ozone - 0.10 ppm for 1 hr.

SO - 0.04 ppm

* Since the State standards for contaminants were revised
in November, 1970, the values will not be the same as
in the similar table in the 1969 Profile.

Sources: Los Angeles County Air Pollution Control District,
Profile of Air Pollution Control, 1971, pp. 75-79.

Los Angeles County Air Pollution Control District,
Profile for Air Pollution in Los Angeles County,
1969, pp. 60-63.

As a result of a court action filed against the EPA for non-compliance with the 1970 Act with respect to California, the EPA has submitted a Plan to meet the 1975 air quality standards. Among the provisions recommended for the South Coast Air Basin are the following:¹⁰⁵

- . New sources of industrial emissions of 100 tons or more annually will be required to obtain permits from both the EPA and the State Air Resources Board before construction can be commenced.
- . Possible gasoline rationing for automobiles each year from May 1 to October 31 beginning in 1975.
- . Promotion of a mass rapid transit system.
- . Required annual motor vehicle inspections.
- . Fleet conversion to natural gas or propane fuel systems.
- . Required installation of catalytic devices on all cars.
- . Various controls to prevent hydrocarbon compounds in numerous industrial processes.

Conclusion

Given both present petrochemical fuel consumption trends and technological capabilities for emission control all we will have, at best, is a holding action against smog. By the very fact that there are days on which current, less stringent standards are exceeded, it is obvious that given the meteorologic conditions of Los Angeles the limit of the atmosphere's ability to cleanse itself is often reached. The Technical Advisory Committee to the State Air Resources Board prognosticates that even with the proposed 1975 auto exhaust emission standard, the maximum hourly average oxidant values in Los Angeles will probably not be below 0.25 to 0.35 ppm by 1980. Even by 1985, the oxidant level will probably be 0.20 to 0.25 ppm.¹⁰⁶ Their conclusion is that drastic changes will have to be made that will have direct and jarring

¹⁰⁵ Los Angeles Times, December 8, 1972, p. 1.

¹⁰⁶ Technical Advisory Committee to the California Air Resources Board, op cit.

effects on residents of the South Coast Air Basin. Their recommendations include:

- . the limitation of the number and use of automobiles, trucks, and aircraft permitted in the basin;
- . reduction of emissions from these sources to levels below those now proposed;
- . the removal or making essentially emission-free all industries and fossil-fuel power plants in the basin;
- . the development of a comprehensive non-polluting urban transport system;
- . the limitation of population growth by sharply restricting subdivision and residential expansion in the basin;
- . the limitation of commercial and industrial growth to zero-emission facilities;
- . the restriction of emissions from commercial, agricultural, domestic and recreational sources.

The smog problem in Los Angeles cannot be solved by stopping population growth alone. The numbers of people are already here, so growth will occur, if only by natural increase. Therefore, we must plan for orderly growth using ecological principles.

It is obvious that the primary offender is the automobile and our virtually total dependence upon it as a local form of transport. The problem keeps getting worse as we go from 2 to 3 to 4 car families. Some form of mass transit system must be built in the Los Angeles Basin to serve as a viable alternative to the automobile. Construction should begin now. The citizenry must realize that implementation of mass rapid transit can no longer be forestalled on the basis of economic considerations alone, (i.e., the argument of whether or not we have the proper density to warrant such a system). The issue is now one of public health. If citizens are not willing to fund such a system, they must realize that they will continue to pay in terms of long-term chronic health degeneration and its concomittant costs.

The City should take other measures to ameliorate the smog situation. In the short run, it could convert all City-owned fleet vehicles to natural gas and restrict the use of automobiles within the central city, utilizing peripheral parking facilities in conjunction with an expanded mini-bus service to facilitate internal circulation. The City should consider regulating the building of gasoline stations more stringently, give serious consideration to density limitations within the city, and begin concentrating growth and allowing for residential opportunities proximate to work opportunities.

APPENDIX
DEFINITIONS

The words listed below are defined as they are intended to be used in the text of the Conservation Plan and the Staff Report related to that Plan. The definitions are offered as an aid to reading these documents and are not officially adopted definitions. An alphabetical listing is provided.

<u>Aggregate</u>	A mass or assemblage of soil particles, more or less firmly held into a structure unit.
<u>Alluvium</u>	Sedimentary material, deposited by flowing water in the flood plain of a stream.
<u>Association, soil</u>	A group of defined and described soils that is regularly geographically associated.
<u>Aquifer</u>	A water bearing stratum of permeable rock, sand, or gravel.
<u>Beach Drifting</u>	cf. footnote 1 in section on Coastline Erosion.
<u>Bedrock</u>	The solid rock underlying soils at a depth from zero to several hundred feet.
<u>Beneficial Use</u>	Uses of the waters of the state that may be protected against quality degradation.
<u>Bore Hole</u>	A test hole used or intended to be used for exploration for oil and gas which subsequently may be used for production.
<u>Breakwater</u>	Linear structures placed offshore and parallel (or nearly so) to the shoreline to protect it from the erosive effects of waves.

<u>Coastal Water</u>	Waters of the Pacific Ocean outside of enclosed bays and estuaries which are within the territorial limits of California.
<u>Contamination or "Contaminate"</u>	Refers to an impairment of the quality of waters by waste to a degree which creates a hazard to the public health through poisoning or the spread of disease.
<u>Denudation</u>	The removal of earth materials.
<u>Detritus</u>	The materials resulting from the breaking up, disintegration and wearing away of rocks.
<u>Drainage</u>	The rate or extent of removal of water from the soil. Seven classes of soil drainage are recognized, as follows:

very poorly drained--Water is removed from the soil so slowly that the water table remains at or near the surface the greater part of the time. Soils of this class usually occupy level or depressed sites and are frequently ponded.

poorly drained--Water is removed from the soil so slowly that the soil remains wet for a large part of the time. The water table is commonly at or near the surface during a considerable part of the year.

somewhat poorly drained--Water is removed from the soil slowly enough to keep it wet for significant periods but not all of the time. Somewhat poorly drained soils commonly have a slowly permeable layer within the profile, a high water table, additions through seepage, or a combination of these conditions.

moderately well drained--Water is removed from the soil somewhat slowly, so that the profile is wet for a small but significant part of the time. Moderately well drained soils commonly have a

slowly permeable layer within or immediately beneath the solum, a relatively high water table, additions of water through seepage, or some combination of these conditions.

well drained--Water is removed from the soil readily but not rapidly. Well drained soils are commonly intermediate in texture, although soils of other textural classes may also be well drained.

somewhat excessively drained--Water is removed from the soil rapidly. Some soils are shallow, have little horizon differentiation, and are sandy or very porous.

excessively drained--Water is removed from the soil very rapidly. Excessively drained soils are commonly shallow, steep, and very coarse or porous.

Drift

As used here, those sediments carried along by the longshore current.

Ecosystem

A complex of ecological community and environment forming a functioning whole in nature.

Effective Depth

The depth to which a soil is readily penetrated by roots and utilized for extraction of water and plant nutrients. Limits of depth classes are:

<u>Depth Class</u>	<u>Inches</u>
Very deep	more than 60
deep	36 to 60
moderately deep	20 to 36
shallow	10 to 20
very shallow	less than 10

Effluent

The liquid left after processing of industrial and domestic waste by wastewater treatment plants or wastewater reclamation plants.

Erosion

1) As used in the Beach erosion section, erosion is defined as a process involving the acquisition, transportation and subsequent deposition of earth materials.

2) As used elsewhere erosion is defined as the wearing away of the land surface by running water, wind, ice, or other geological agents. The following terms are utilized to describe different kinds of erosion:

accelerated erosion--Erosion which has been significantly increased by human activity, or by domestic animals.

geological erosion--Erosion caused by the action of the geological agents which have normally acted on the land surface.

gully erosion--Erosion caused by intermittent moving waters, creating relatively deep narrow channels in the land surface.

natural erosion--Synonymous with geological erosion.

rill erosion--Erosion caused by moving water creating many small, nearly parallel channels in the land surface.

sheet erosion--Erosion caused by water moving more or less uniformly over the land surface.

splash erosion--Erosion caused by the impact of raindrops on the soil surface, loosening and detaching the surface soil.

Erosion Hazard

The relative susceptibility of the land to the prevailing agents of erosion.

<u>Flood Plain</u>	The land bordering a stream, built up of alluvial sediments, and subject to inundation when the stream is at flood stage.
<u>Groin</u>	A man-made coastal structure, generally placed perpendicular to the shoreline. Ranging from relatively open to completely impervious, controlling (or inhibiting) they build or maintain beaches by the quantity of drift materials transported by the longshore current.
<u>Groundwaters</u>	All potentially usable subsurface waters that occur in and below the saturated zone.
<u>Groundwater Recharge or "Recharge"</u>	Is the practice of artificially supplementing the natural recharge supply in the spreading grounds.
<u>Horizon</u>	A layer of soil or soil material approximately parallel to the land surface, and differing from adjacent genetically related layers in physical, chemical, and biological properties or characteristics.
<u>Humus</u>	The well-decomposed, more or less stable part of the organic matter in mineral soils.
<u>Import</u>	Earth materials transported to a grading site.
<u>Infiltration rate</u>	A soil characteristic which determines the maximum rate at which water can enter the soil under specified conditions. Formerly designated infiltration capacity.
<u>Infiltration Velocity</u>	The actual rate at which water may be entering the soil at any given time.

Inherent
Fertility

The relative capacity of the soil to supply nutrients to growing plants, without additions of fertilizers or soil amendments.

Jetty

Impervious structures placed seaward from the mouth of a river to direct and confine stream and tidal water and to prevent littoral drift from shoaling the channel.

Longshore Current

(also littoral currents) - Locally occurring ocean currents caused by the impinging of major currents upon the outline of the shore and/or by deflection when waves break obliquely along a shore.

Longshore drifting

Transportation of marine sediments by longshore currents.

Morphological

Relates to the form and structures of animals.

Offshore Area

Shall mean all property in the City of Los Angeles between the mean high tide line and the outermost seaward City boundary.

Overburden

Material overlying a deposit of useful geological materials usually of substance other than that being extracted.

Paleontological

Pertaining to that science dealing with pre-historic forms of life through the study of plant and animal fossils.

Pollution or
Pollutants

Refers to an alteration of the quality of the waters by waste to a degree which unreasonably affects: (1) such waters for beneficial uses, and (2) facilities which serve such beneficial uses. Pollution may include contamination.

<u>Quality of the Water</u>	Refers to chemical, physical, biological, bacteriological, radiological, and other properties and characteristics of water which affect the uses.
<u>Reclaimed Water or Water Reclamation</u>	Relates to water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur.
<u>Receiving Waters</u>	Waters upon or into which a discharge is made.
<u>Sea Water Intrusion Barrier</u>	Formation of a barrier to prevent contamination of the groundwater by sea water. This barrier is created by injecting fresh water to create a fresh water pressure ridge.
<u>Series, soil</u>	A group of soils which have essentially similar properties and sequence of horizons, except the texture of the surface soil.
<u>Slickenslides</u>	Polished and grooved surfaces produced by one mass sliding past another. In soils, slickenslides may occur at the base of a slip surface on a relatively steep slope, and in swelling clays, where there is marked change in moisture content.
<u>Soil</u>	A natural, three dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate, and living matter acting upon parent material, as conditioned by relief over periods of time.
<u>Soil Classes and their permeability rates are:</u>	very slow; less than 0.05 inches per hour. slow: 0.05 to 0.20 inches per hour. moderately slow: 0.20 to 0.80 inches per hour. moderate: 0.80 to 2.5 inches per hour. moderately rapid: 2.5 to 5.0 inches per hour. rapid: 5.0

to 10.0 inches per hour. very rapid: more than 10.0 inches per hour.

Special Biological Significance

Those marine ecosystems which are so extraordinary or unique that no acceptable risk of change in their environmental or biological components can be incurred.

Spreading Grounds

Areas where water is flooded so that it can penetrate into the underground aquifers.

Subsoil

Technically, the B horizon; roughly, the part of the profile below plow depth.

Surface soil

The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Temporary Geological Core or Core Hole

A seismic test hole or exploratory core hole used or intended to be used exclusively for geophysical or geological exploratory work preliminary to possible exploration for oil and gas to be drilled and abandoned within 30 days from the time of commencement of actual drilling operation.

Texture, Soil

The relative proportions of sand, silt and clay particles in a mass of soil. (See also clay, sand and silt). The basic textural classes, in order of increasing proportions of fine particles are: sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay and clay. The sand, loamy sand and sandy loam classes may be further divided by specifying "coarse", "fine", or "very fine."

<u>Tombolo</u>	A V-shaped sand bar that often builds seaward from a beach protected by a breakwater. A classic local example is to be found at the Venice Pavillion.
<u>Topsoil</u>	A presumed fertile soil or soil material, ordinarily rich in organic matter, used to topdress roadbanks, lawns and gardens.
<u>Thermal Waste</u>	Cooling water and industrial process water used to transport waste heat.
<u>Type, soil</u>	A subdivision of the soil series based on the differences in the texture of the surface layer.
<u>Wastewater</u>	Water polluted by industrial or domestic wastes and normally discharged into the ocean after treatment.
<u>Wastewater Reclamation</u>	The process which produces a secondary or tertiary treated effluent of sufficient quality to meet State Health Department standards for wastewater reuse.
<u>Wastewater Treatment</u>	The process which produces a primary or secondary effluent of a quality which is satisfactory to meet State Water Quality Control Board standards for receiving waters.
<u>Water Table</u>	The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

BIBLIOGRAPHY

WATER

Anonymous, "A Federal View of Water Pollution Control", Environmental Control Management, Vol. 138, No. 5 (November, 1969).

_____, "On the Use of Reclaimed Waste Waters As A Public Water - Supply Source", Journal of the American Water Works Association, Vol. 36, No. 490 (August, 1971).

_____, Newsweek, November 27, 1972.

Biniek, Joseph P., Economics of Water Pollution Control Measures, United States Department of Agriculture Economic Research Service, Natural Resource Economic Division, Washington, D.C. (undated).

Cairns, Jr., John, "We're in Hot Water", Scientist and Citizen, Vol. 10, No. 8, (October, 1968).

California State of, The Porter - Cologne Water Quality Control Act (Bulletin containing related Water Code Sections containing the 1971 Amendments, dated March, 1972).

California, State of, The California Advisory Commission on Marine and Coastal Resources, Fourth Annual Report 1971 - The California Marine Environment.

_____, The Resources Agency, State Water Resources Control Board, Interim Water Quality Control Plan for the Santa Clara River and Los Angeles River Basins, (June 1971).

_____, Water Quality Control Plan for Ocean Waters of California (July 6, 1972).

_____, The Resources Agency, Department of Water Resources, Watermaster Report 1970-71.

Clark, John R., "Thermal Pollution and Aquatic Life", Scientific American, Vol. 220, (March, 1969).

Eliassen, Rolf, et. al., Studies on the Movement of Viruses in Groundwater - Final Report, Water Quality Control Research Laboratory, Department of Civil Engineering, Stanford University, Stanford, California (May, 1967).

Los Angeles, City of, Report on the Feasibility of Wastewater Reclamation by the City of Los Angeles, Departments of Water and Power, Public Works, and Recreation and Parks (October 10, 1968).

Marine Advisers, Inc., The Marine Environment Offshore the Los Angeles Department of Water and Power Scattergood Generating Plant, January-February 1970 Survey, Solana Beach, California, (March 1970).

Ruhlow, Jerry, "Delay Sought on Ordinance to Bar Harbor Pollution", Los Angeles Times, February 19, 1970).

Seaborg, Glenn T., "Looking Ahead in Nuclear Power", Mechanical Engineering, Vol. 91 (August, 1969).

Simpson, Larry D., Summary Report - Storms of 1969, Los Angeles County Flood Control District (June, 1969).

Southern California Association of Governments, Beneficial Uses of Water in the SCAG Area, (October, 1972).

United States Department of the Interior, Federal Water Pollution Control Administration and the American Public Works Association, Water Pollution Aspects of Urban Runoff, (January, 1969).

SOILS

California, State of, The Resources Agency, Division of Soil Conservation, Environmental Impact of Urbanization on the Foothill and Mountain Land of California (November, 1971).

_____, Landslides and Subsidence, Geologic Hazards Conference, Los Angeles, California, May 26-27, 1965.

Kern, County of, Open Space and Conservation Element (June, 1972).

Los Angeles, City of, Department of Building and Safety, Guide for Erosion and Debris Control in Hillside Areas (November, 1970).

_____, The Mayor's Ad Hoc Landslide Committee, Landslides and Attendant Problems, A Report to the Mayor of the City of Los Angeles, (March 28, 1967).

Schoustra, Jack J. and Thomas D. Lake, "Los Angeles Hillside Developments Put to Test by Recent Rains", Civil Engineering, Vol. 39, No. 11 (November, 1969).

U.S. Department of Agriculture, Soil Conservation Service, Report and General Soil Map, Los Angeles County, California, Lancaster, California, (June 1967, Rev. 1969).

FISHERIES

Bell, Robert R., California Marine Fish Landings for 1970, Fish Bulletin 154, California Department of Fish and Game (1971).

California, State of, The Resources Agency, Department of Fish and Game, California's Living Marine Resources and Their Utilization, Edited by Herbert W. Frey (1971).

Carlisle, Jr., John G., "Results of a Six-Year Trawl Study in An Area of Heavy Waste Discharge: Santa Monica Bay, California", California Fish and Game, Vol. 55, No. 1, (January, 1969).

Fay, Rimmon C., et. al., An Evaluation of the Health of the Benthic Marine Biota of Ventura, Los Angeles and Orange Counties, report prepared for the Southern California Association of Governments, (February, 1972).

Heimann, Richard F. G. and John C. Carlisle, Jr., The California Marine Fish Catch for 1968 and Historical Review 1916-68, Fish Bulletin 149, California Department of Fish and Game (1970).

Leighton, D. L., et. al., "Ecological Relationships Between Giant Kelp and Sea Urchins in Southern California". Reprinted from Proceedings of the Fifth International Seaweed Symposium, Halifax, August 25-28, 1965, Pergamon Press, Oxford, (1966).

Pinkas, Leo, The California Marine Fish Catch for 1969, Fish Bulletin 153, California Department of Fish and Game (1970).

SCCWRP Progress Report, Southern California Coastal Water Research Project, (May 5, 1972).

Sheehan, Joe, "Back from Perdition", Outdoor California, California Department of Fish and Game (January-February/March-April, 1971).

United States Archives, Code of Federal Regulations, Title 50, Part 17, Conservation of Endangered Species and Other Fish or Wildlife (Includes Amendments through May 19, 1972).

U.S. Army Corps of Engineers, Los Angeles-Long Beach Harbors, Preliminary Draft Environmental Statement (November, 1972).

HARBORS

Engineering Science, Inc., Report on Ecosystem Management Alternatives, prepared for the Department of Harbor, City of Los Angeles (September, 1971).

U.S. Army Corps of Engineers, Los Angeles-Long Beach Harbors, Preliminary Draft Environmental Statement (November, 1972).

WILDLIFE AND BOTANIC COMMUNITIES

California, State of, The Resources Agency, Department of Fish and Game, At the Crossroads, A Report on California's Endangered and Rare Fish and Wildlife (January 1972).

Kern County of, Open Space and Conservation Element, (June, 1972).

Leach, Howard, "Who Declares Wildlife Endangered or Rare", Outdoor California, California Department of Fish and Game (January, 1972).

Los Angeles, City of, Department of Recreation and Parks, Park Ranger Division, Hansen Dam Nature Trail Guide, (undated).

Raven, Peter H., Native Shrubs of Southern California, University of California Press, Berkeley (1965).

SAND AND GRAVEL

Anonymous, "100 Largest Sand and Gravel Plants",
Rock Products, (October, 1969).

_____, "Ecology and Economics", Rock Products,
(November, 1969).

American Society of Planning Officials, Land Use
Control in the Surface Extraction of Minerals,
Information Report No. 153, Part 1 (December,
1961).

California, State of, Revenue and Taxation Code.

_____, Health and Safety Code.

_____, California Division of Mines
and Geology, Statistical Bulletins.

Gillelen, Frank, Rock and Gravel Deposits in the
San Fernando Valley, Report to the City Council,
City of Los Angeles (September 1, 1964). City
Planning Case No. 877; City Council File No. 25166,
Sup. #1 and Sup. #2, unpublished.

Goldman, Harold B., Sand and Gravel in California:
An Inventory of Deposits, Part C - Southern
California, California Division of Mines and
Geology, (1968).

Goldman, Harold and Edmund Kiessling, Memorandum
re: "Sand and Gravel Resources in the San Fernando
Valley, California", written for California
Division of Mines and Geology, (February 17, 1969).

Los Angeles, City of, Zoning Code.

_____, Department of City Planning,
City Plan Case No. 20547-B (1970).

_____, Department of City Planning,
City Plan Case No. 21908, (November 27, 1968).

_____, Department of City Planning,
An Environmental Conservation Element for the
Los Angeles City General Plan, Staff Working Paper
(August, 1970).

Thornbury, W. D., Principles of Geomorphology,
Wiley & Sons, New York (1954).

AIR QUALITY

Anonymous, "Plant Biologist Claims Trees Help to Rid Air of Pollution", Los Angeles Times (August 18, 1972).

_____, Los Angeles Times (December 8, 1972).

California, State of, The Resources Agency, Air Resources Board, Annual Report (1968 and 1970).

_____, Implementation Plan for Achieving and Maintaining the National Ambient Air Quality Standards (January 30, 1972).

Los Angeles County Air Pollution Control District, Profile for Air Pollution in Los Angeles County (1969).

_____, Profile of Air Pollution Control (1971).

Kauper, Erwin K. and Charlotte J. Hopper, "The Utilization of Optimum Meteorologic Conditions for the Reduction of Los Angeles Automotive Pollution", Air Pollution Control Association Journal, Vol. 15, No. 5 (May 1965).

Mueller, Peter K. and Margaret Hitchcock, "Air Quality Criteria - Toxicological Appraisal for Oxidants, Nitrogen Oxides, and Hydrocarbons", Air Pollution Control Association Journal, Vol. 19, No. 9 (September, 1969).

Rydell, C. Peter and Gretchen Schwarz, "Air Pollution and Urban Form: A Review of the Current Literature", Journal of American Institute of Planners, Vol. 34, No. 2 (March, 1968).

Stein, Richard G., "A Matter of Design", Environment Vol. 14, No. 8 (October, 1972).

Technical Advisory Committee to the California Air Resources Board, Recommended Air Quality Standards Applicable to All Air Basins, Sacramento (September, 1970).

U.S. Department of Health, Education and Welfare, Public Health Service, Air Quality Criteria for Sulfur Oxides, PHS No. 1619 (1967).

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In compliance with Section 65302(d) of the California Government Code, consultation was had with the following agencies concerned with the development, distribution, control, and conservation of water:

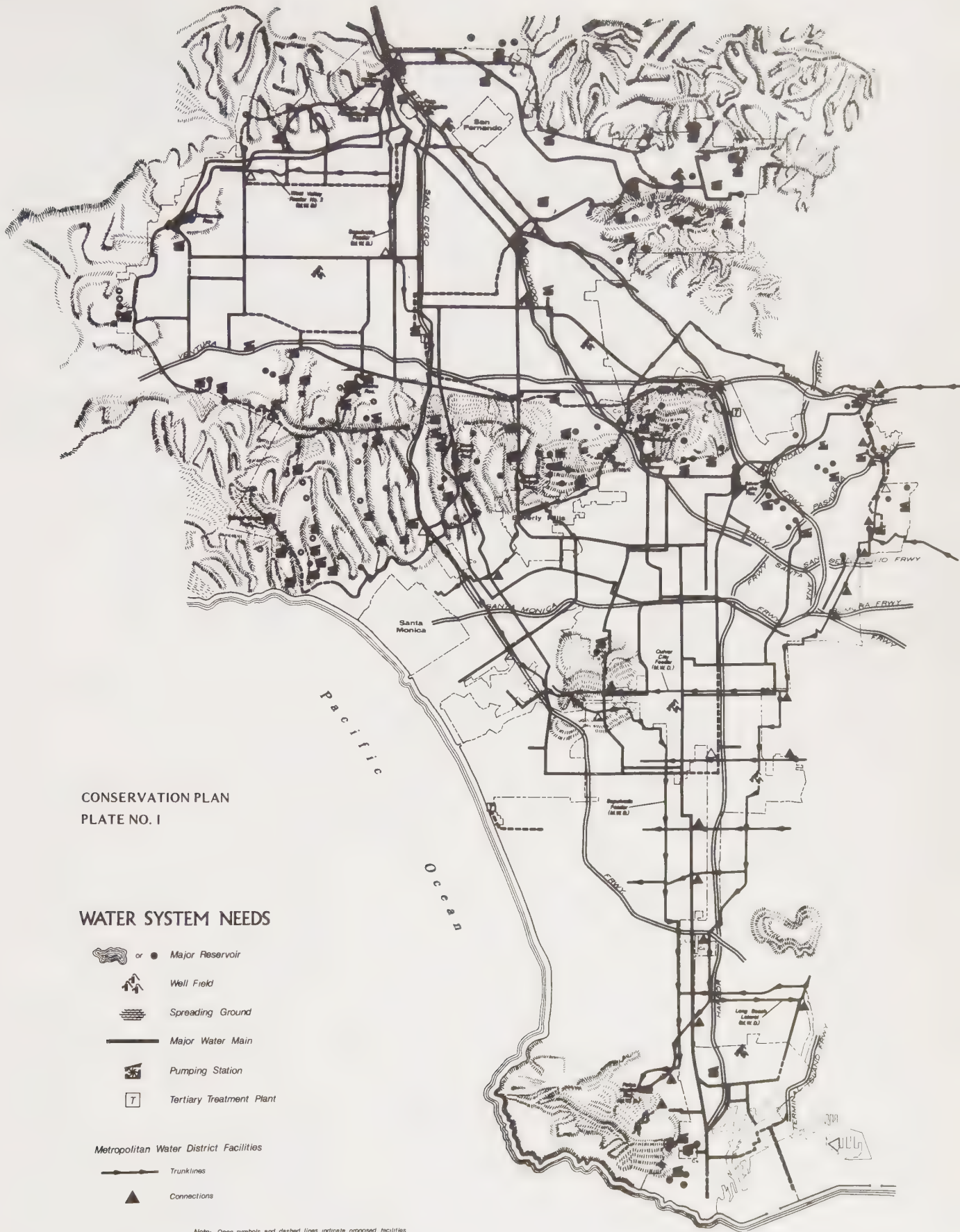
City of Los Angeles, Department of
Water and Power, Paul H. Lane
Chief Engineer of Water Works
and Assistant Manager

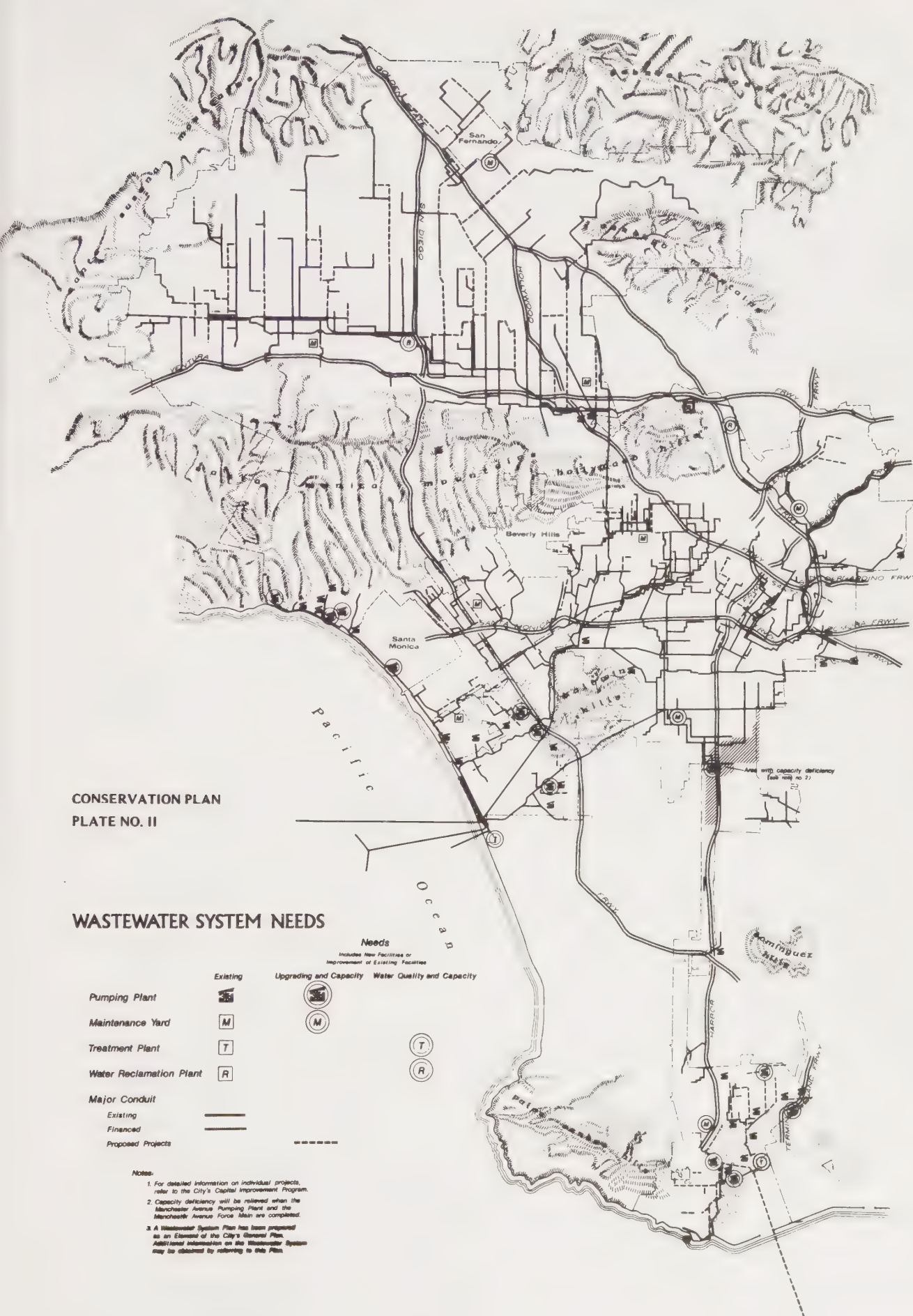
City of Los Angeles, Bureau of Engineering,
Donald C. Tillman, City Engineer

City of Los Angeles, Bureau of Sanitation,
Robert D. Bargman, Director

Los Angeles County Flood Control District,
Arthur Bruington, Chief Engineer

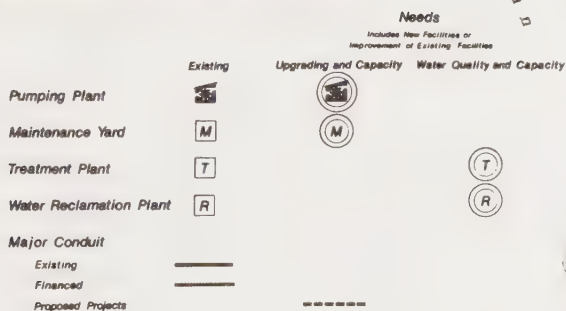
State of California, The Resources Agency,
California Regional Water Quality
Control Board, Los Angeles Region,
Raymond Hertel, Executive Director





CONSERVATION PLAN
PLATE NO. II

WASTEWATER SYSTEM NEEDS



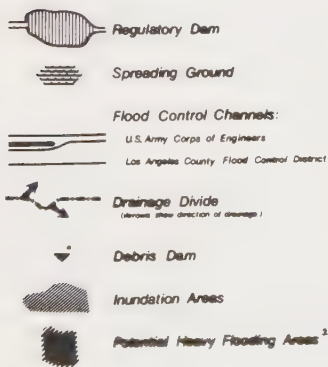
Notes:

1. For detailed information on individual projects, refer to the City's Capital Improvement Program.
2. Capacity deficiency will be relieved when the Manchester Avenue Pumping Plant and the Manchester Avenue Force Main are completed.
3. A Wastewater System Plan has been prepared as an Element of the City's General Plan. Additional information on the Wastewater System may be obtained by referring to this Plan.



CONSERVATION PLAN
PLATE NO. III

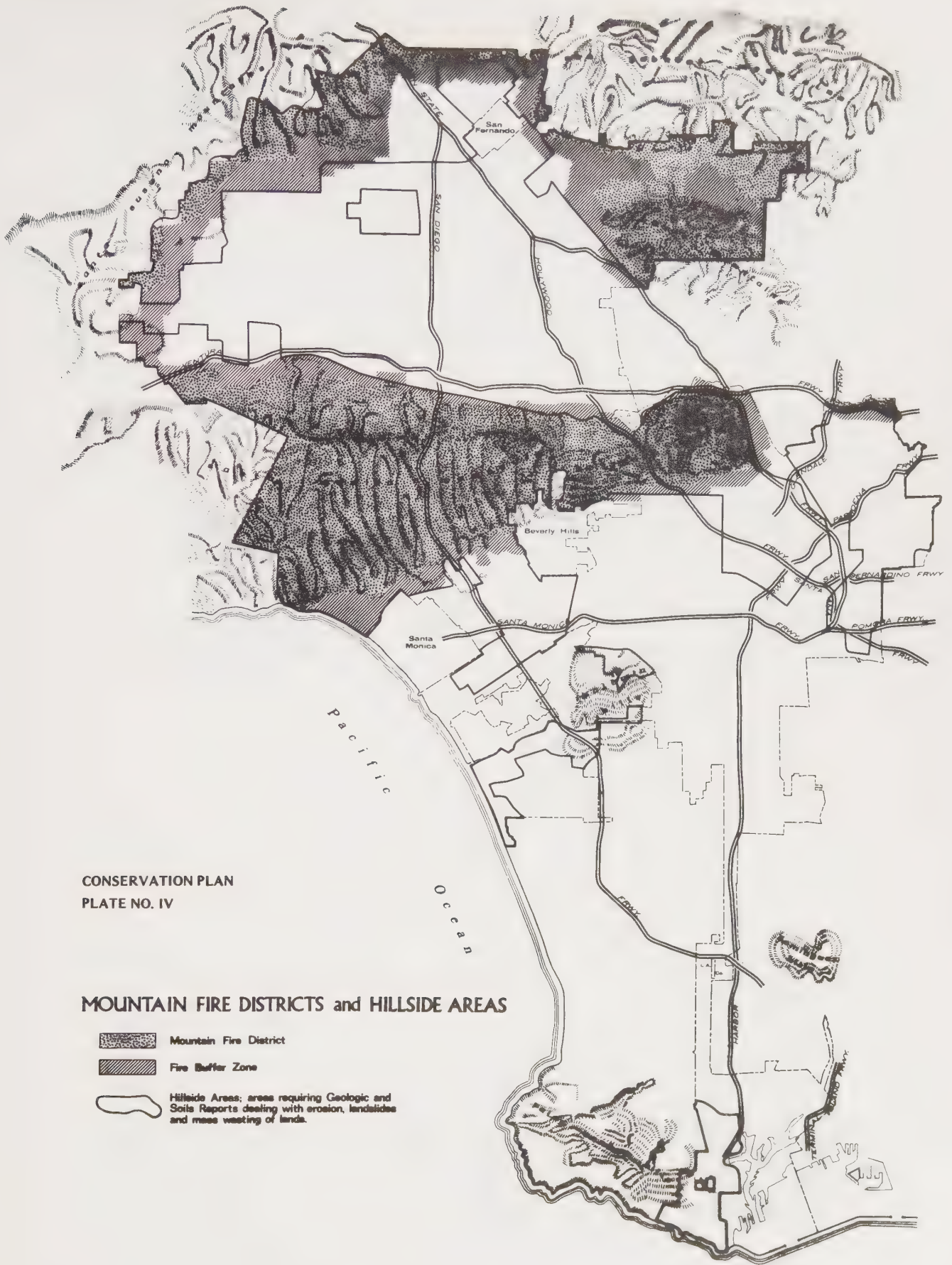
DRAINAGE SYSTEM NEEDS and
POTENTIAL FLOOD HAZARD AREAS



Notes

1. Inundation Areas and Heavy Flooding Areas shown by hatching, with flooding elevations provided for water to the Los Angeles County Flood Control District 1950 Station Grade Road from, are not shown on this map.
2. Inundation Areas and Potential Heavy Flooding Areas require that building permits be approved by the Bureau of Public Works, Bureau of Engineering, Public Works Department. These permits should be dealt with care and in consultation with the Bureau of Engineering, Public Works Department.
3. Areas subject to heavy flooding during unusual or heavy rains.
4. Open symbols refer to proposed facilities.
5. Hatched lines indicate proposed Flood Control Channels.
6. Drainage Divides are general in location, and are for orientation purposes only.
7. For more detailed information, refer to the Drainage System Element of the General Plan and to the District Office of the Bureau of Engineering.





CONSERVATION PLAN
PLATE NO. IV

MOUNTAIN FIRE DISTRICTS and HILLSIDE AREAS



Mountain Fire District

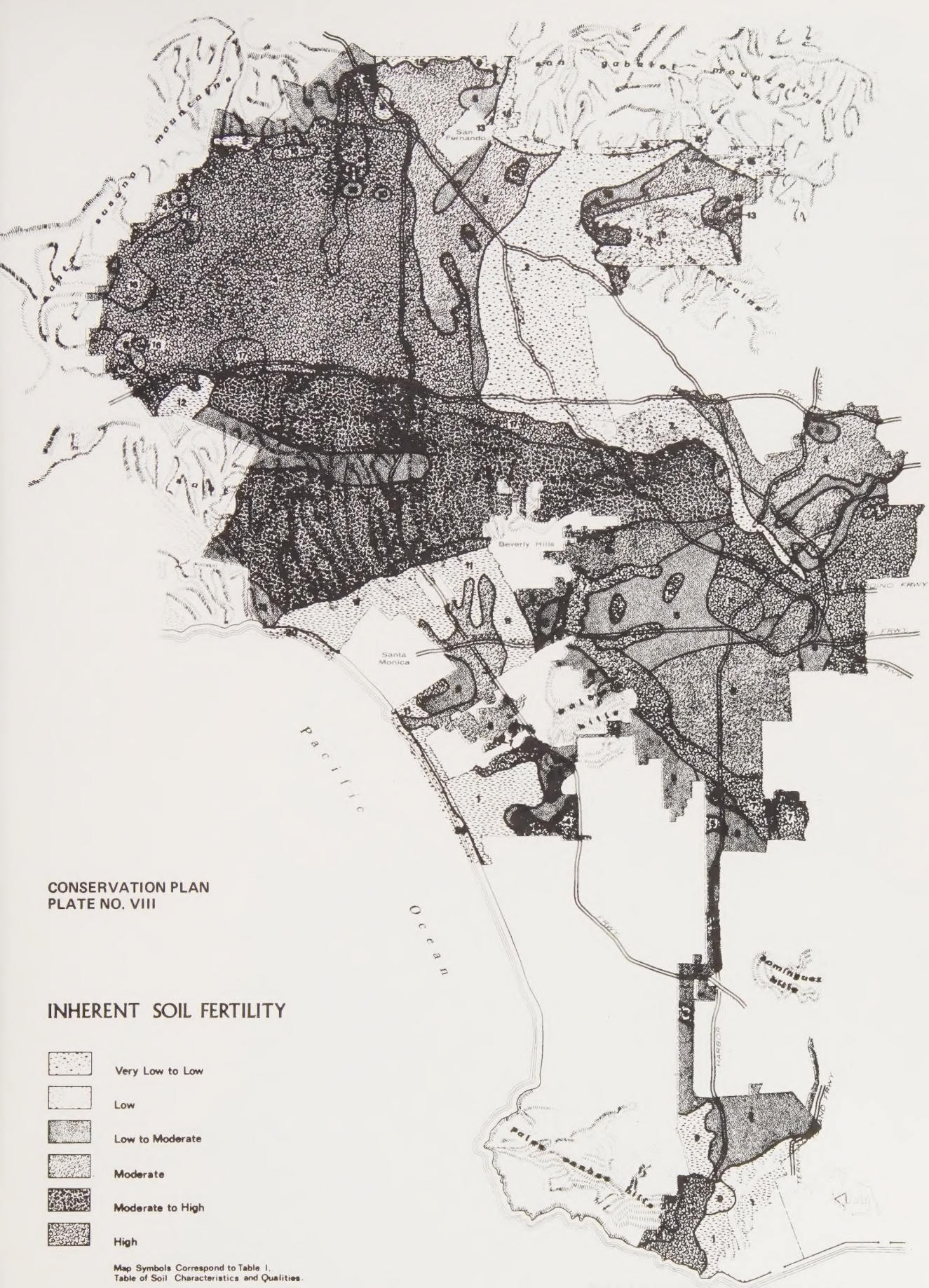


Fire Buffer Zone



Hillside Areas: areas requiring Geologic and Soils Reports dealing with erosion, landslides and mass wasting of lands.





CONSERVATION PLAN
PLATE NO. VIII

INHERENT SOIL FERTILITY

-  Very Low to Low
-  Low
-  Low to Moderate
-  Moderate
-  Moderate to High
-  High

Map Symbols Correspond to Table 1,
Table of Soil Characteristics and Qualities.



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